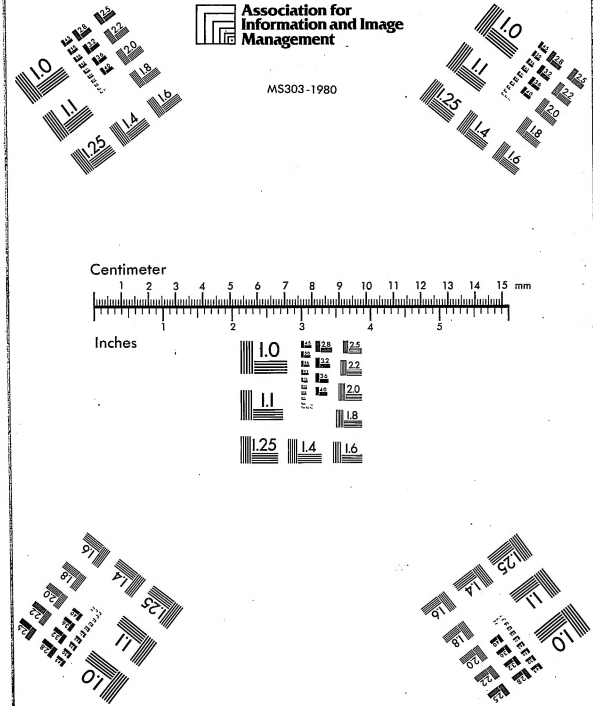
Association for
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MS303-1980
Centimeter
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 mm
1 2 3 4 5
Inches
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

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A SELECTIVE MICROFILM EDITION

PART II
(1879–1886)

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START

37

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 37

NOTEBOOK SERIES (NBK-15)

Menlo Park Notebooks, #114 - #127

Menlo Park Notebook #114 [N-80-08-10]

This notebook covers the period August 1880-January 1881. The entries are by Francis Upton. The book contains calculations, along with occasional notes and drawings, relating to tests of dynamos and motors. There are also a few notes and calculations relating to lamps, meters, and tests of German silver wire. The label on the front cover is marked "Upton," "Motors," and "Machines." The book contains 284 numbered pages.

Blank pages not filmed: 2-3, 8-15, 18-19, 172-173, 206-275, 284.

Aug 10-80

Old paper loop after burning a long time: measured on face 0.063 sq.in as the surface of one face.

0".021 wide

3". long

Let r = resistance machine constant
& R = " " " outside variable

$\mathcal{E}$ = E.M.F transmitter constant

$\mathcal{E}''$ = " " " motor variable

$\mathcal{E}' = \mathcal{E} - \mathcal{E}''$

W = work outside

w = work internal

C = current

W'' = work from motor

$$W = KC\mathcal{E}'' + KC\mathcal{E}' - KC^2r$$

$$= KC\mathcal{E} - KC^2r$$

$$C = \frac{\mathcal{E}'}{R+r} = \frac{\mathcal{E}-\mathcal{E}''}{R+r}$$

$$W = \frac{K(\mathcal{E}-\mathcal{E}'')\mathcal{E}}{R+r} - \frac{K(\mathcal{E}-\mathcal{E}'')^2 r}{(R+r)^2}$$

$$W''_0 = KC\mathcal{E}''$$

$n = \frac{W}{w}$ constant

$l = \frac{R}{r}$ variable

$\mathcal{E} = C(R + r) + \mathcal{E}''$

$W = C(\mathcal{E}' + \mathcal{E}'') - C^2 r$

Estimate for 13 H. P. machine
[illegible] dynamo to run
600 revs direct

Present machine 10 inches
by 10 inches
75 commutators.

7 per H. P.

33000

$$ft.\ lbs = \frac{\mathcal{E}^2}{R} \times \cancel{66}44.3$$

$$7\,\overline{)33000}\quad 4714\,3 = \frac{\mathcal{E}^2}{100} \times 44.3$$

$$\mathcal{E}^2 = \frac{4714\,3.00}{44.3}$$

516758
1.6464
4.0294
2.0147

105 Volts required
of machine

Steamer machine
Mr. Edison wants 30 to one
Say twice the length of present machine then
there will be twice the
3/2 the resistance that
is $3/16 \times .16 = .24$ ohms
resistance to give
the same E.M.F.

The present machine gives
115 Volts at 1100 r.p.m.
with same no. commutators
to go at 600 it would
give $\frac{\cancel{3}600}{1100} \times 115$

$11)\underline{690}$
62.7 Volts

Machine twice as long would
give 125.4 Volts

13 H. P. machine

The present machine has $75 \times 2 = 150$ turns so to give 105 Volts in in place of 125. Volts there would need to be 125 ; 105 :: 150 ;

2.0212
2.1761
7.9031
2.7004

125 turns = 62 commutat

63 commutators

Resistance varies as square the number of commutators so

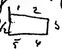
$75^2 : 63^2 :: .24 : X$

$$\begin{array}{r} 1.7993 \\ 1.7993 \\ \bar{1}.3802 \\ \hline 8.1249 \\ 8.1249 \\ \hline \bar{1}.2286 \end{array}$$

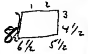
X = .17 Ohm

Suppose 1½ times the diameter and that the wire can be twice as thick the magnets no larger and the same strength of field.

Length of wire 1



6½



13 H. P. Machine

8 : 6.5

$$\frac{8}{6.5} \times \frac{1}{2} = \frac{4}{6.5}$$

$$\frac{2}{6.5} \times .17 = \frac{.68}{6.5}$$

$\bar{1}.5315$
0.8129
$\bar{2}.7186$

.002
~~.052~~ Ohms

.75 Ohms resistance
multiple arc

.75 $\bar{1}.8751$
.052 $\bar{2}.7186$
1.1565

7.3
~~14.3~~ to 1 the ratio
of such a machine
if wire on wider than before

13 H.P. Machine

I think the E.M.F per inch will be 4/3 3/4 ~~of~~ of 10 in. machine the 3/4 the number of commutators will do

$1 : {3/4}^2 :: .102 : x$

since the diameter is 3/2 as great the wire will be 3/2 as wide ~~or~~ 2/3 the resistance of original

$1 : 9/16 \times \frac{2}{3} :: .102 : x$

$1 : 2/5 :: .102 : x$

$\frac{1}{2/5} = \frac{.102}{x}$ $x = .102 \times \frac{2}{5}$

.204

$x = .041$

13 H. P. machine

$\bar{1}.1565$
$\bar{2}.6128$
$\overline{\cancel{2}.5437}$

35 : 1 Ratio

4 | 64
16 — 48 commutators
3
— 48 commutators

Suppose 51 commutators

.042 — 1.6232
2
3.2464

1764 mills

.0425
17
.052
.052
.106
17
.093

93 — 1.9685
2
3.9370

8649

13 H.P. Machine

Present machine

8".95 on end diameter

Cutter 0".17 wide

Larger machine

9.73 inches in center

9.50 on end

9.
3.14

29.26

1.4664
150 2.1761
$\bar{1}$.2903

0".195

.200
.159
.041 for peg

.200
.165
.035 for peg

13 H.P. Machine

9.5 0.9777
3.14 0.4971

29.87 1.4748
150 2.1761

.199 $\bar{1}$.2987

0".2 space for wire
cutter 0".17

.042
.011
.053
~~3~~
~~.77~~
0".159

10
9.73
.29
16
.11

Leng 0".013 covering
.165

13 H. P. Machine

~~14" machine~~

~~3.14~~

~~5' 3.4~~ ~~1.7275~~

Commutator ~~571~~ ~~1.7076~~

~~.0199~~

~~1.04 to space = 0".52~~

~~0".52~~

~~3 wires side by side~~

~~4 wire deep~~

~~0".52~~

~~.03 for vulcanized fibre~~

~~3 | 0".49~~

~~0".163~~

~~0" .015~~

~~0".148~~

~~.05~~

~~10.~~

13 H. P. Machine

14" machine

43.98 circum

4.398 1.6433
102 2.0086

1.6347

.431
30 for leg
.401
.131 for covering
.013
.118
2
.236 thick

.131
2
.262

~~.737~~

.131
3
.393

.159
2
.318

3X3

See page 51 for 4 moves in notch

13 H.P. Machine

Twice as long

20" length
14" diameter
34
2
68" for ends
6
74" one turn
102 turns
148
74
4 | 7548 | 1/4 resistance
12 | 1887
157.2 feet of wire equals resistance of machine

O.K.

13 H.P. machine

Wire ^{0} ·118 = diam

$$\begin{array}{r} 2.0719 \\ 2 \\ \hline 4.1438 \end{array}$$

14000 mills
9 wire
126000 mills

9.718	0.9715
157.2	2.1964
Comp 126000	4.8996
	8.0671

$\bar{2}.0671$

·011 Ohms
2
·022

13.14

Present machine

0.042

$$\begin{array}{r} 1.6232 \\ 2 \\ \hline 3.2464 \\ 6 \quad 0.7782 \\ \hline 4.0246 \end{array}$$

10500 mills

$$\begin{array}{r} 10 \\ 10 \\ \hline 20 \\ 2 \\ \hline 40 \\ 3 \\ \hline 43'' \\ 150 \\ \text{comp } 12 \\ \text{comp } 4 \end{array} \qquad \begin{array}{r} 1.6335 \\ 2.1761 \\ 8.9208 \\ 9.3979 \\ \hline 2.1283 \end{array}$$

134 feet

13. H. P. machine

	9.71	0.9872
	134	2.1271
comp	10500	5.9788
		9.0931

·124

Whereas it is ·14 Ohm

4/·55

·14

30/75

·025

5 0

13 H.P. Machine

4 ⌊.401

.100
13

.087

0 0 0 0
0 0 0 0
00 0 0
00.0 0

1.9395
1.9395

3.8790

7570
8

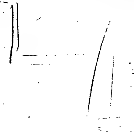
60560

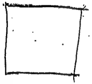
0.9715
2.1964
5.2179

8.3858

24.4

.024





100 H. P. machine

Bore 20".5

Plates 20" to 19".5

2' 4" over all

100 r. p. m
gives 8 Volts on present
machine.

600 would give
※ 75 turns
48 Volts

Taking this as the number
of 75 turns and
three times as long

$$\begin{array}{r} 48 \\ 3 \\ \hline 144 \end{array}$$ Volts

100 H.P. Machine
It is desired to

obtain an average
of the lamps now made

~~188~~
~~156~~
~~147~~
~~187~~
~~157~~
~~153~~
~~137~~
~~151~~
~~181~~
~~178~~
~~186~~
~~165~~
~~166~~
~~159~~
164 .15

164

2494 3.3967
1.1761
2.2206

166

100 H.P. Machine

Page 105 Ohm lamp

45970 5.8092
18470 1.2553

64440 3.5539
18

~~4020 ft lbs~~

~~4020 ft lbs~~

4.5185
3.60

.9143

8.2 per H.P.

3420 ft lbs

4.5185 9.2 per H.P.
3.5539

.9646

100 H. P. Machine

45970
18470

64440   4.8092
18   1.2553

3.5539
3580   4.5185
.9646

9.2 ~~Ohms~~ W per horse power

9.2 per Horse power

~~8 per H.P.~~

$$\frac{E^2}{R} 44.3 = \text{ft. lbs}$$

3.5539
2.2175
8.3536
4.1250
2.0625

115 Volts required

100 H.P. Machine

8) 33.000

4125   3.6154

2.2176

8.3586

4.1865

2.0932

124 Volts 2.0932

1.0654

7.0782 5

3.6153

135 Volts will be

enough

~~1511~~

75 : 69 :: 144 : 132

1.8388
1.1584
8.1249

1.1221

100 H.P. Machine

144 Volts from machine
with 75 commutators

135 Volts required

144 : 135 :: 75 : 70.3

1.8751
2.1303
7.8416

1.8470 70.3

71 is prime
73 is prime
75 is not

Make 69 commutators
Will give 132 Volts

100 H. P. Machine

20" on plates

20
3.14
$\overline{62.80}$ circumference

69 commutators
2
$\overline{138}$ divisions

1.7981
2.1399
0".455 space $\overline{9.6582}$

Space 0".455

100 H. P. Machine

19".5 Diameter plates

.69
2
―――
138 divisions

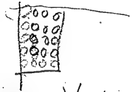
||

19.5   1.2900
0.4969
―――
61".2 circumf   1.7869
2.1399
―――
9.6470

0".444 for each space

0".02 for peg
0".02 for insulation
0".05 for separation
―――
0".394 for wire

0".394 to place wire in side ways.



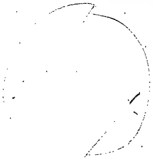
4 wire X 5 wires in space

allow 0".009 for covering on each wire

0".036 for four wires

0".394
0".036
4)·358 X 455
0".0895

Wire 0".09 Diameter



100 H. P. Machine

8100 circular mills
20 wires
162000 circular mills in space

Armature

29" long
20" diameter
5" Extra
54"
2
108" of wire

9 feet of wire

69
9
621 feet of wire

155.2 Equiv resistance

 10"X10" Book 37 page 177

Surface 470 sq.in.

100 H.P. Machine

Resistance

10.64 Ohms resistance mill foot

	10.64	1.0273
Comp	162000	4.7905
	155.2	2.1908
		8.0086

0.0106 Ohms internal resistance

Lamp 165 Ohms

800 lamps

800) 165

.206

.21

Will give ratio of 20:1

 Book 37 p. 176 20" X 30"

Surface 2488 sq. in.

600 lights 165 Ohms each

20 | .275 Ohms

.0137 conductor

.2887 $\bar{1}$.4604

.0106 $\bar{2}$.0253

1.4351

27.2

9 per H.P. 9 | 600

66.6 H.P.

66.6 1.8235

33000 4.5185

Comp 27.2 8.5654

~~comp~~ 80800 4.9074

comp 2488 6.6041

1.5115

32.2 ft. lbs per sq. in.

100 H. P. Machine

$132^2 : 115^2 :: 0.0106$

8.0086

2.0607

2.0607

7.8794

7.8794

7.8888

.00774

9.3139

7.8888

1.4251

26.6 to 1

Considering conductor

28 : 1

100 H. P. Machine

Suppose square wire

Bergmans Generator and bell

Handle up and down

$$\begin{array}{r} 3100 \\ 2 \\ \hline 6200 \end{array}$$

6200 Ohms rings bell

No Shunt

Turning generator by handle

$$\begin{array}{r} 1500 \\ 1100 \\ 3200 \\ 1600 \\ \hline 7400 \end{array}$$

Continually moving

6200

Bergmann's generator & Bell
new Aug 12 1880

Shunt	Line
500 Ohms	1500 2000 3500 Ohms
250 Ohms	700 2200. 2900. ohms
100 Ohms	1400 Ohms
50 Ohms	600 Ohms
30 Ohms	500 Ohms
20 Ohms	300 Ohms
1.0 Ohms	100 Ohms
7 Ohms	Rang

Surming
5 Ohms

1.6902
7.5126
9.9957

9.1985 .158 Webers
9.3579

$\bar{2}$.5564 .0360 Volts

~~706 = D~~

$C = \frac{E}{R}$ Meter

$R = EC$

from Book 39, p. 121.

307.5 = D for 1 Volt

49 = D around 1.01 Ohms

$\frac{49}{307.5} \times \frac{1}{1.01}$ Webers

.158 Webers through the line.

Shunts 0.114
0.114
0.228 Ohms

$C = \frac{E}{R}$ $E = CR$

0.036 Volts on Shunt

Meters
from Book 39 p 121 -

706 = D from 0.158 Webers on 1.016 Ohms

706   2.8488
0.7943
3.6431

4400 = D from 1 Volts through galva. with shunt = ∞ both ways

$0.158 = C \quad R = 1.016$

$C = \frac{\mathcal{E}}{R} \quad \mathcal{E} = CR$

$\bar{1}.1987$
0.0070
$\bar{1}.2057 \quad .154$ Volts

On page 124 4610

Line to Lamp factory

	325	2.5119
Comp	39.75	8.4008
	21.6	1.3345
		2.2471

176 Volts

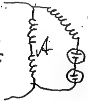
Deflection 325
with 27 Ohms. in Shunt

Meters from Book 39 page 1p 42

The galvanometer with a shunt = ∞ would give 4610 for a deflection with one Volt at its extremities.

Plain

0.114
0.114
0.228



B = 4.1
4.2
8.3 Ohms

To give Weber though B

4610	3.6639
8.3	0.9191
38280	4.5830

To indicate one Weber through cells 38280 = D from galva

Meter from Book 39 p. 121

66	1.8195
38280	4.5830
	.7.2365

.00172 Webers through cells

90	1.9542
Comp. 4610	6.3363
	8.2905

2)0.0195 Volts
0.00875 Volts on one cell

110	2.0414
Through cells	4.5830
.00287 Webers	7.4584

111	2.0453
	6.3363
	8.3816

(.02407 Volts
.012 Volts on one cell

180 2.2553
120 2.0792
1.5 .1761

2.4564
2.2227
1.71 .2337

180 2.2553
comp 38280 5.4170
.0047 Webers 7.6723
through cell

120 2.0792
6.3363
8.4155

1.026
.013 Volts on one cell

28.6 2.4564
5.4170
.00747 Webers 7.8734
through cells

167 2.2227
6.3363
8.5590

1.0362
.0181 Volts on cell

2.6042
2.2856
2.08 .3186

4.1577 4.5830
3.2386 3.6639
.9191 .9191

.402 2.6042
5.4170
8.0212

Webers .0105
through cells

193 2.2856
6.3363
8.6219

(.0418

.02095 Volts on one cell

Shunt changed 2000 Ohms
219 = deflection around
A whereas 583 was the
deflection before
583 ; 219 :: 4610 :

3.6639
2.3404
7.2343
1733 3.2386
Deflection from one Volt

2.2646
1.8573
.4075 2.55

Meters; Book 39, p.125.

583 : 219 :: 38280 :

4.5830
2.3404
7.2343
4.1577

14370

184 2.2648
Comp 14370 5.8423
8.1071

0.0128 Webers through cells

72 1.8573
Comp 1733 6.7614
8.6187
1.04158
.0207 Volts on cell

Meters Book 39 p. 129

221 2.3444
5.8423
.01538 8.1867
Webers

79 1.8976
6.7614
8.6590
.3010
.0228 Volts 8.3580
on. one cell.

302 2.4800
5.8423
.021 8.3223
Webers

84 1.9243
6.7614
8.6857
.3010
.02427 8.3847
Volts on one cell

Meters Book 39 p 131

434 2.6375
5.8423
8.4798

.03010 Webers

98 1.9912
6.7614
8.7526

1566
283 35 Volts on one cell

3.14
2.05
1870
628
64370

3.14

360 2.5563
2.9891
5672

1 0.147 Webers through cells
0.068 Volts on one cell

2 0.193 Webers through cells
0.083 Volts on cell

3 0.264 Webers through cells
0.105 Volts on cell

4 0.315 Webers through cells
0.123 Volts on cell

5 0.365 Webers through cells
0.134 Volts on cell

Suppose a shunt of .02 Ohms on a metre and 1 Ohms in with depositing cell

165 Ohm lamp
120 Volt

$\frac{120}{165}$ 2.0792
2.2175
9.8617

.727 Webers in the circuit for each lamp

.01 Weber flowing through

.01 19.7 mg. per minute

1 Weber

19.5	1.2900
60	1.7782
	3.0682
hours 5	
Day 290 450	2.6532
	5.7214

526.000 mg.

.52.6 Kilo.

.268 lbs. of Cu.. per quarter

~~[illegible]~~

.001 Weber

.0268 lbs of Cu per quarter

.02 Volt due to polarization

and E. M. F. at .001 Weber

.727 Webers per lamp

in main circuit.

.01

$\frac{1}{100}$

10 Ohm

.01 Weston shunt

1 Lamp

.00727 Volt active on

also shunt .0727 Volt on .01 Ohm

10 Ohms with it

---

10 Ohms

.002 Weber

.2 Volt from resistance
from cells

.023

.223 Volts at shunt

.001 Weber

.1

.02

.12 at Shunt

.005 Weber

.0

.01 Ohms shunt

01 .01

20 / 165
8.25

825 : 1 ratio 20 lamps
82.5 : 1 ratio 200 lamps
.1 Ohm shunt

82.5 to 1 20 lamps

or 8.2
.1 Ohm in shunt
for 20 lamps meter
can afford that much

~~at~~ .01 Weber flowing through cell deposits about .0268 lbs. of Cu. per quarter

---

a quarter contains 450 hours = 90 × 5

[illegible] grains make one lb

[illegible] mg 1 gr.

[illegible]

1 mg per hour

20 lamps

$$\begin{array}{r} .0268 \\ 020 \\ \hline 0.5360 \end{array}$$

1/2 lbs per quarter

Aug 19 1880 FRU

.005 Weber per lamp

20 lamps 1/4 lbs per quarter

.005

On .1 Ohm Shunt
Page 105 .727 Webers
flowing through meters

.0727 Volts in shunt

$.005 \overline{).0727}$
145.4

$\frac{1}{145.4}$ shunt ratio
1/4 lb. per quarter from
20 lamps

Estimate cost gas

Suppose

~~1~~4000000 Costs Gas

$3,600,000 received

4000000
.15

600,000.00

$600,000 M lost

$540.000 lost

Makes 4,600,000 M

36) 460 (12.8
36
100
72
280

4,6 .6628
3,6 .5563
.1065

9727

4.6) 3.6 (

0,5563
0,6628
.8935

78.2 cts

4,6

3) 78.2 3

78.2)

4.600000 M yearly

$4{,}6 \times .782 \neq 3.6$

$4.6 = \frac{3.6}{.782}$

.78
600000

468000000

$464.000 .78

.78
2 000 000

$ 1,56 000 000
468000
2)2.028000 | 2600 000

1012

~~2024000~~

$ 1.012

2.600.000

Estimate cost gas

Gas sold

2.000.000
600000

2.600000

1.800000 to sell at
90 cts.

.2553
.4150

.8403

.69 cts must be
made ~~for~~

If 15% is lost of gas
made - ~~90cts~~ sold at 90cts
cost 78.7cts

If 1/2 of present amount is
sold *
must be sold at $1.01

Electrodyne

$$f = \frac{c\,L\,m}{k^2}$$

$$c = \frac{f\,k^2}{L\,m}$$

1752
1.25
8760
3504
1752
219.000

4 layers

25 Volts
25
125
50
625
44.3
1875
2490
2490
$\boxed{27577.5}$
13788
3 magnets
40364

165
18

292 turns one layer

1752 gave 2 ohms
15 Webers
30 Volts
90 volts on 3 magnets

20 Volts
20
400

44.3
400
17720.0
8860 ft. lbs.

60
6 Ohms
120

Must be able to get
25 Volts 12.5 Webers
on magnet

75 Volts on three magnets

125 Volts to spare

Strength magnet = C T

C = Current
T = No. turns

$R = \frac{V}{a}$ $C = \frac{E}{R}$

$75 : 125 :: 6 : 10$

$$\frac{125 \times 6}{750}$$

10 Ohms on magnet

Same length wire and

same number of turns

c^2R = cost of current

aT = wt ~~cost~~ of Cu

$c^2 R =$ m

$a J =$ n

$J c = X$

$\xi =$ variable

$R = \frac{J}{a}$

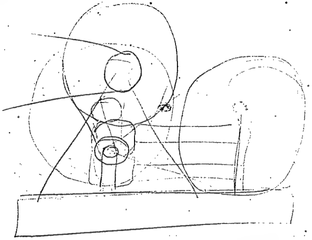
$c^2 \frac{J}{a} =$ Cost.

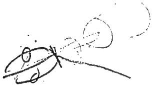
$C^2 R = m$ constante

$C^2 \frac{J}{a} = m$

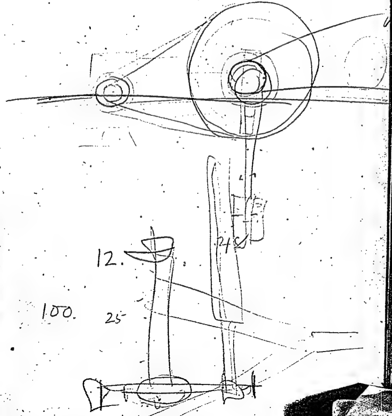
$c =$

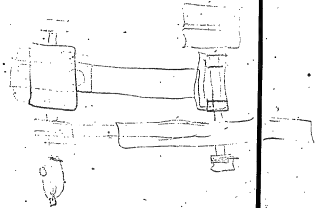
Motors



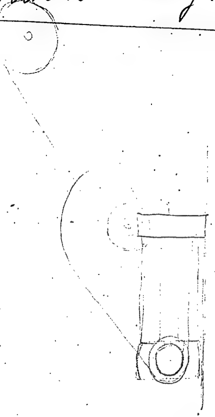


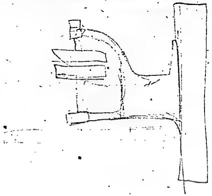
Motors aug 30

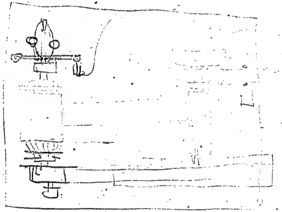




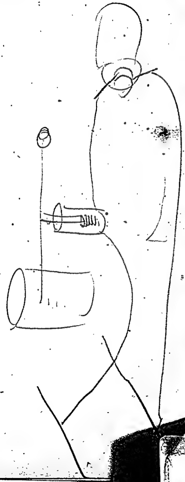
Motors Aug 30, 1880







12



Estimate of Motors

Mr. Edison makes condition that at 1000 r. p. m. the motor shall give 96 Volts.
Small wrought iron motor gives 65 Volts at 1640 revo.
6 turns ~~will give~~ to division

Large present 10"X10" Machine

.55 Ohms at 1100 revs
gives 220 Volts
at 1000 revs 200 Volts

200 lbs
50 600 lbs of Cu 10

1 ct an hour
8
8 cts per day

365
.08
$ 29.20

$292
72

3 layers
$60 per layer
4 13

1752
12.5
8770
3504
1752
21901.0

Magnets

1752 turns of .134 wire
gives .2 ohms
12.5 Webers saturates

25 Volts in magnet
with 3/120 Volts on line
40 Volts for each
magnet to give same
strength.

No. 11 Wire
.120 in diameter

7"½ diameter

3' 6"½

```
 .120
 .013
 ----
 .133
```

```
 12
  3
 --
 36
 6.5
 ----
 42.5
```

```
.133 ) 42.500 ( 319.5 Turns
       399
       ---
        260
        133
        ---
        1270
        1197
        ----
         730
```

~~25 volts~~

~~2.8) 25.0 (9.~~ Webers

~~1919~~
~~9~~
~~17271~~

40 volts

2.8) 40 (146
28
120
104
160

3 layers

7.5
0.133
.066
7.699

Wrong

958.5
2
1919 turns

319.5
3
958.5
7.7
6706
6706
12) 73716.6
614 feet
2
1228
3.1 = π
1228
3684

2.8 ohms

1392) 3806.8 (2.73
2784
10228
9744
4840

1919 . 3.2833
.1139
3.3972

40 Volts 1.6021
.3636
1.2385
3.3972
432 4.6357

4 Layers No. 11 Wire

7.5
.133
.066
.133
.066
7.898 diameter
Wrong

7.9
3.1
7.9
237
24.49 24.5" one turn

24.5 1.3892
1919 3.2833
comp 12 8.9208
feet 3920 3.5933
1.33 .1139
3.7072
5100 3.1436
1392 .3636
3.6 Ohms

43.56   163 91
6700   1.8284
5.4675

293 lbs

.5 Layers No. 11 Wire

7.5   .133
.665   05.
8.165   .665

3.1   .4914
8.16   .9117
319.5   2.5045
3195 turns   10   1.
Comps 12   8.9208

3.8284
6700 feet   3.1436
1392
4.8 Ohms   .6848

40 Volts   1.6021
.6848
.9173
3.5045
26400   4.4218

magnet large machine
No. 12 Wire

.109 = Diameter
.025
.134 = Space taken by wire

3
12
36
6.5
42".5 length of magnet

42.5 1.6284
.134 1.1271
2.5013 317 turns

5 layers .134
5
.670
7.5
.67
8.17
3.14
317
10
comp 12
6780 feet

0.9122
0.4969
2.5011
1.
8.9208
3.8310

600

[illegible]

[illegible]

6780 3.8310
1149 3.0603

5.9 Ohms .7707

40 Volts 1.6021
.7707

678 Weber .8314
3170 3.5011

4.3325

21500

5 layers

6 Ohms

6780
3

20340 feet ~~1~~.3083
35.9 1.5551

2.8634

730 lbs.

3.281
12

6562
3281

39.372 = 1 Meter

1mm = .0394

$\frac{39.4}{1000}$

39.4
6
218.4

583
.0394
23.00

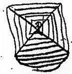
21 7657
2. 5955
4.3612

German Silver Book 104 page 53

.0106

a = thickness
b = width

$R = \frac{L}{ab}$



$R = \frac{L}{ab} = \frac{L}{ab}$

0106

X = Resistance per square mil ~~1 foot long~~ 1 inch long

$R = \frac{L}{ab} X$

$X = \frac{abR}{L}$

a = 11

b = 6mm = 39.4 X 6
= 218.4

L = 583mm = 23. ~~23.00~~

39.4	1.5955
25	1.3979
985	2.9934
437	$\bar{2}$.5955
	2.6405
17.2	1.2360

$$X = \frac{11 \times 218.4 \times .16}{23.}$$

1.0414	1.0414
2.3385	2.3385
$\bar{2}$.0253	$\bar{1}$.2041
8.6383	8.6383
.0435	1.2223
	16.

1.10 Ohms

Strip No. 2

Res = .0216 Ohms

Thickness = 0".011 = a

Width = 25 mm = b

Length = 437 mm = L

a = 11.

b = 985.

L = 17.2

$$\cancel{X} = \frac{a b R}{L}$$

1.0414
2.9934
$\bar{2}$.3345
8.7640
1.1333

~~136~~ 13.6

39.4	1.5955
.608	$\bar{1}$.7839
	1.3794

39.4	1.5955
35	1.5441
	3.1396

Strip 4

Res = 0.0222 Ohms
Thickness = 0".011
Length = 608 mm
Width = 35 mm

a = 11
b = 1380
L = 23.9

1.0414
3.1396
$\bar{2}$.3464
8.6206
1.1480 ~~1.40~~ 14. Ohms

sq. Mill inch ~~138~~ 13.8

The smallest circuit will have 30 lamps on all the times.

3 ~~0~~ / 16.5 ohms
5.5 ohm total

120 Volts on 5.5 ohms

120 volt

120 : .04 :: 5.5 : X

$$\begin{array}{r} .04 \\ 120\,)\,.220\,(\,.00183 \\ 120 \\ \hline 1000 \\ 960 \\ \hline 400 \end{array}$$

Shunt 0.00183 ohms
3" X 12" XX

$L = 12$

$b = 3000$

$a = x$

$R = .00183$

mil inch $= 1.38$

$$\frac{13.4}{\cancel{1.38}} = \frac{x \times 3000 \times .00183}{12}$$

$$x = \frac{12 \times \cancel{1.38}\ 13.8}{3000 \times .00183}$$

$$\begin{array}{r} .00183 \\ 3000 \\ \hline 5.49000 \end{array}$$

$$\begin{array}{r} 13.8 \\ 12 \\ \hline 276 \\ 138 \\ \hline 165.6 \end{array}$$

5.49

$$\begin{array}{r} 2.2175 \\ 0.7396 \\ \hline 1.4779 \end{array}$$

$x = 30$

Nov 25 1880

67.75

12.25

1.8309
2
3.6618
2.1762
1.4856
3010
1.7866

1.0881
2
2.1762

61.2
~~61~~ candle

12
8
96
8.5
104.5

Nov. 26

1.54 Ohms

8 feet - 8.½ inches

gives 1.54 Ohms

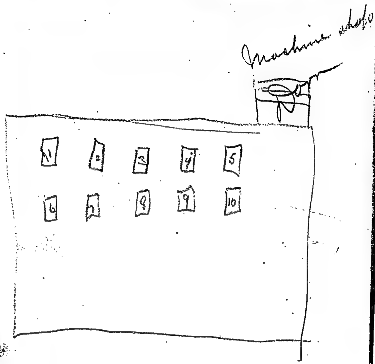
1.54 : 10 :: 104.5

1.54) 104.5,00 (677 inches
924
1210
1078
1320

50 feet

12) 677
56 feet 5 inches
60 feet 10 Ohms
6 1 Ohms

Machines for multiple arc. The magnet for ~~the~~ a .55 Ohm machine ran by the exciter
This machine ran the fields of nine other machines in series each 1.4 Ohm



1 Machine No. 5 160 R

2 " No 4 158 R

3 " No. 3 160 L

4 " No. 11 153 L

5 " No. 10 160 R

6 No 7 148 L

7 No 6 153 R

8 No — 147 R

Machine No,	5	150	R
"	4	157	R
No	5	155	R
No	4	157	R
No	3	157	R
No	11	148	R
No	5	149	R

40 lbs steam

No	11	150	R
	6	159	R
No	5	155	R
No	6	155	
No	7	150	

No. 5	145
10	153
No 5	142
No. 10	150
No —	141

20 lbs steam

No. 5.	145
No. 10	156
No. 6	150.
No 5	153
No 10	160

No 5	148
No 4	146
No. 5	148
No 3	148
No. 5	150
No. 11	148
No. 5	150
No. 10	160
No. 5	150
No. 7	154
No. 5	150
No. 6	152
No. 5	148
No. 6	148
5	145
	142

No. 5 145

a 303
168–168

307
170–170

312 a
160–160

318a
160–160

322a
165-165

328a
172-172

320a
170-170

308a
175-175

313 a
175 — 175

320 a
165 — 165

325
166 — 166

329
152

Dec. 23, 1880.

Test of small wrought iron motor. Field wound with 70 Ohms of No. in multiples are with ~~armature~~
armature .61 Ohm

Copper plates placed in line with armature

wt Cu plates

No 1	117.272	Grammes
" 2	118.000	"
" 3	117.170	"
" 4	116.380	"

Motor running
2400 r.p.m

140 = D around terminal

2-56 Started
Second hand at 30"

2-59 $\begin{array}{r} 1370 \\ 2 \\ \hline 2740 \end{array}$ r.p.M

140 = D

117.530
117.272
258

118.000
117.690
.310

117.170
116.850
.320

116.635
.380
255

Wrought iron motor 2600 r.p.m.

3-6 Stopped

1900 revs in 3/4 minute
633 4
2532 r.p.m.

Plates

No. 1	117.530
2	117 690
3	116 850
4	116.635

Result
6000 ~~ft~~ lbs. required
~~to~~ drive motor 2600 r.p.m.

1.45
6
.860

140
140
1280
93 Volts

40
40
1600
40
64000

1.45
93
435
1305
134.85

135
44.3
405
540
540
598.05

6000

6000 ft. lbs

27 6

258
310
320
255
1143
10 | 286 mg.

19.7) 28.6 (1.45 Webers
19.7
8.90
788
1020

$C = \frac{E}{R}$

$R = \frac{E}{C}$

Work $= \frac{E^2 44.3}{R} = \frac{E^2 44.3}{\frac{E}{C}} = E.C.\ 44.3$

5 Lamps

5)1300
26 Ohms

.61

100
100
10000
.6)443000 0
33)738,3~~00~~
23

3.7686
0.3979
0.0654
4.2319

3.7686
.1761
0.0654
40101

3.8340
10000 ft. lbs.

3.4116
1.9645
6.5850
1.9611

93.0
91.5
1.5

.86 : 1.5 :: 5870 : X

2000
1980

Jan 1881
QRR

2600

1,45 Webers
93 Volts at Terminals

.6 Ohm = resistance

.86 Volt active
5870.5 ft. lbs

2600 : 2580 :: 92.14 : X = 92.14

93
.86

2600 : 1600 : 93
13 8
13) 744 (57
65
94

2580 : 2560 :: 91.5 : X

1.9614
3.4082
6.5884

1.9580
93.
90.8

2.2

3.8340
.3424

4.1764

15,000 ft. lbs.

61 Ohm

Rewind so as to
give 1.75 Ohms and
twice the turns or
E.M.F.

1300 Revo. per minute
Same E.M.F.

= 92.14 Volts contrary
.86 " active

~~[illegible]~~ 92.14 Volts
~~[illegible]~~

92.14

3000 ft lbs saved by slower speed

2580 : 25604 :: 91.5 : X

1.9614
3.4082
6.5884
1.9580

93.
90.8
2.2

3.8340
.3424
4.1764

15,000 ft. lbs.

61 Ohm

Rewind so as to give 1.75 Ohms and twice the turns ~~E.M.F~~ 5

1300 ~~Revo.~~ per minute
Same E.M.F per

= 92.14 Volts contrary
.86 " active

~~Counter-volts~~
~~Sensory Volts~~
92.14 Volts

92.14

3000 ft lbs saved by slower speed

γ_2

$\boxed{110}$

110 Volts on line
92.14
17.86

17.86 Volts active

1.2520
1.2520
1.6464
9.7570
3.9074 8080 on machine as heat

110 92.14 1.9640
17.86 8.7480
8080 3.9074
4.6269

41,700 ft-lbs from motor

92.14 1.9645
·110 2.0414

·9231

~~83.8%~~ 83.8%

of speed that is needed to equal whole E.M.F on line.

No regulation needed

12
6
72

13
7
91

16
9
144

$9\overline{)33000}$
3666.

72
91
16

1.18573
8.0401
1.2041
1.1015

12.6 candles
8.4 candles

$9\overline{)2550}$
283 ft. lbs

33000

4.5185
2.4518
2.0667
.1.2041
.8626

116

7.2 per H.P.

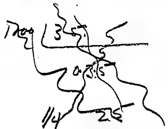
178

9.8

11. for H.P.

~~3.5 lamps~~

12	13	141
144	13	23
	39	164
	13	
	1.69	



165 Ohms

165	2.2175
169	7.7721
144	2.1584
~~165~~	2.1480
141	2.
24	

2.2175
2.1480
.0695
0.7782
.8477

1.17

7.04

5 1/3 candles

2250 3, 3522
5.33 0. 7267
2.6255

422 ft. lbs per candles

4.5185
2.6255
1.8930

78 candles per H. P.

1.8930
.7267
1.1663

14.6

Lamp Aug. 8, 1880

16
7
112

33000 4.5185
112 2.0492
2.4693

295 ft. lbs per candles

16
8

Present lamp 4" loop.

9 candles.
4 1/2 6" loop
13 1/2 candles 9/8
12.~~1/2~~ candles

7 per H. P.

About 12 candles

1/4 more surface added will give 16 candles

$$R = a\frac{l}{d^2}$$

$$S = b\,l\,d$$

$$R\,d^2 = a\,l$$

$$d^2 = \frac{a}{R}\,l$$

$$d = c\sqrt{l}$$

$$S = cb\,l\sqrt{l}$$

$$l = \left(\frac{S}{cb}\right)^{\frac{2}{3}}$$

0, 1, 2, 3, 4, 5, 6, 8, 9, 10, .0

$S = \frac{5}{4} = 1.25$

.0969
2
.1938
.10646

2.85
.021
2.85
570
.05985
.021
3.
.063

.12
2.4
.0096

.0096
4.8
.009
~~.0445~~
.0432 .6"

6
.4
.46

6
2
1.2
4.8

Menlo Park Notebook #115 [N-80-07-19]

This notebook covers the period July-October 1880. The entries are by Charles L. Clarke. The book contains calculations, notes, and drawings relating to the electric railroad, especially the design of the locomotive. There are also four pages of notes and calculations about copper conductors and two scaled template patterns for dynamos. The label on the front cover is marked "C. L. Clarke." The book contains 284 numbered pages.

Blank pages not filmed: 142-279, 284.

xE;172

N-80.07.19

What resistance of lamps.
What do for field magnet.

1/100 . 100 feet

Clarke

1/6

Electric locomotive.

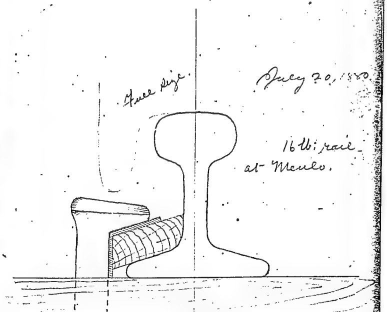
July 19, 1880.

Head light.
Whistle.
Brakes.

Clarke.

Full size

July 20, 1880.



16 lb. rail
at Menlo.

Wooden wedge and
washer to be two
inches in length

33)528(16
33
198

54
150
2700
54
8100

33)105600(3.2
99
66

July 20, 1880. Clarke,

A standard light passenger car on the Penn. R.R. weighs 39 300 lbs. and carries 54 passengers.

Speed 30 m. per hour
or 2640 feet per m.

If we take a ton as 2000 lbs. and resistance as 10 lbs. per ton, each ton will consume 2640 × 10 = 26400 ft. lbs. per m. at speed of 30 miles per hour. Each car (20 tons) would therefore require 26400 × 20 = 528 000 ft. lbs. = 16. H.P.

Suppose the passengers to average 150 lbs. weight, the total will be 54 × 150 = 8100 lbs = 4 tons.

The power consumed due to passengers will be 26400 × 4 = 105600 ft. lbs. = 3.2 H.P.

The H.P. required per loaded car will be 19.2 H.P.

over

$\frac{16}{100}$ $\frac{16}{6500}$ 16) 6500 (400
52,8
.0400
2,112 ~~00~~

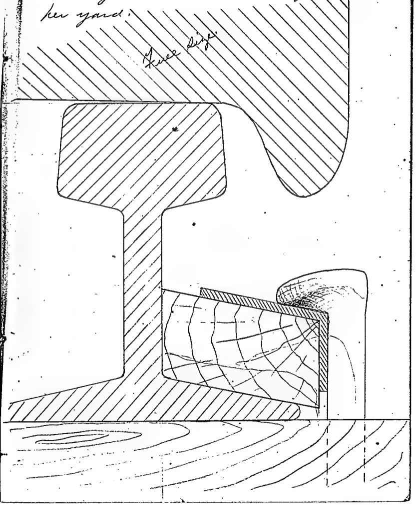
52,8
.04
2,112

52,8
.01
.528

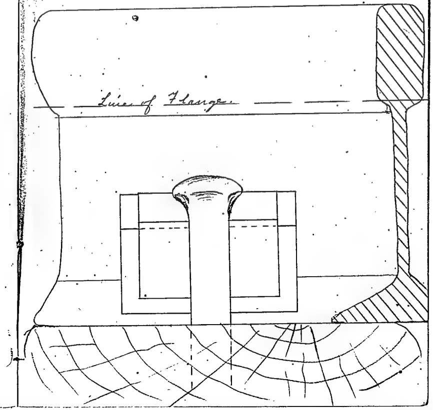
The entire weight of one loaded passenger car is 24 tons and the resistance due to that car is (24 × 10) = 240 lbs.

5 cars would require (19.2 × 5) = 96 H. P. and a resistance of (240 × 5) = 1200 lbs. and if only one tenth of the weight on driving wheels is the adhesion (or often being as high as one fifth or even one third under most favorable conditions of track and weather) the required weight is 1200 × 10 = 12000 = 6 tons.

Standard steel or iron rail on Pennsylvania R. R. weighs 67 lbs. per yard.



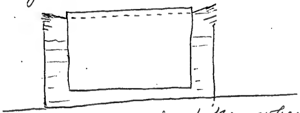
Clarke.



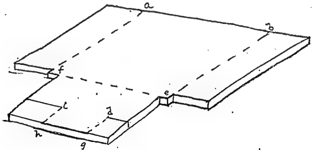
July 21, 1880.

Clarke.

Instead of making the angle-washer shorter than the wooden insulation, thereby crushing into the wood on account



of pressure of spike when the rail buckles in the passage of a heavy load, it may be cut in this shape and then is to be

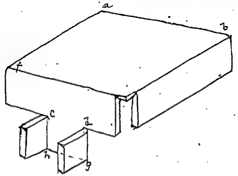


bent along the dotted lines

as shown below; the wooden insulator and angle washer are thus

July 21, 1880.

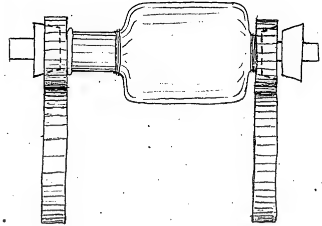
Clarke



held immovable by the spike.
If the wood be two inches long there will be four square inches bearing on the flange. I think it advisable to make it three inches in length.
Even if not thought desirable to flange the angle washer it ought to have a length equal to that of the wood.

Electric - locomotive. July 21, 1880

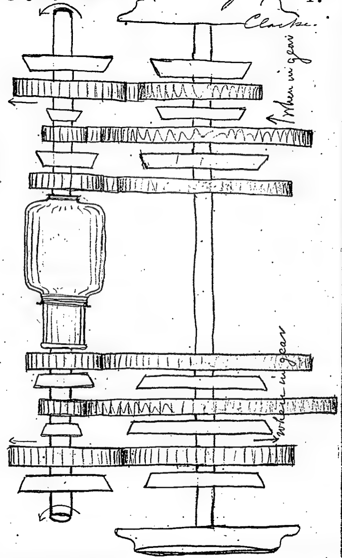
Clarke.



Electric locomotive — July 21, 1880.

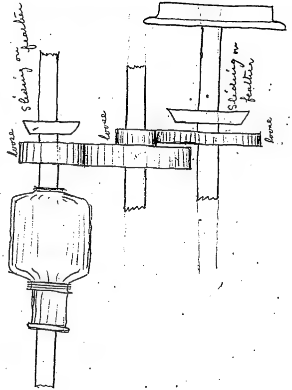
Clarke.

Spur wheels all loose; Cone clutches sliding on feathers;



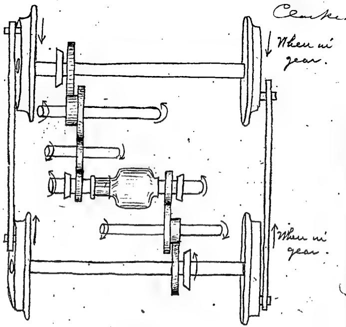
Electric Locomotive, July 22 1880,

Clarke,



Electric locomotive, July 22, 1880.

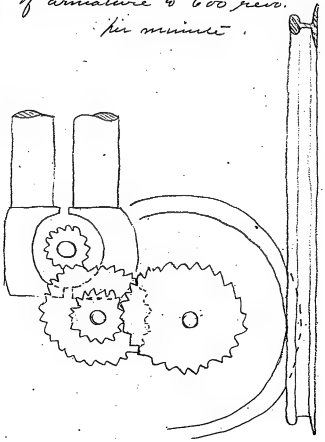
Clarke.



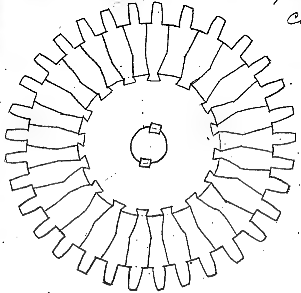
Spur wheels loose,
Cone clutches sliding on feathers.

Electric locomotive. July 22, 1880.
Clarke

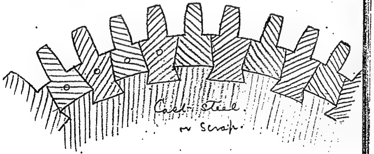
Reduce the constant speed
of armature to 600 rev.
per minute.



Electric locomotive. July 22, 1880, Clarke



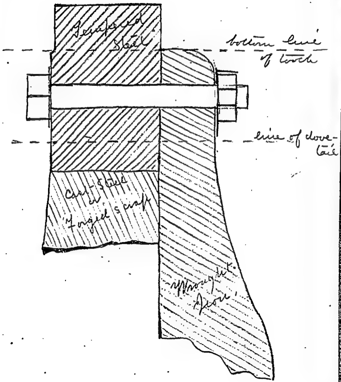
Tempered steel teeth.



Electric locomotive, July 23, 27 1880,

Section of tooth showing fastening

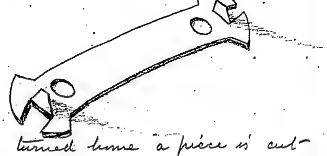
Clarke.



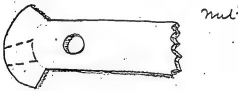
Electric locomotive, July 22, 18.

Clarke,

Each pair of bolts will be connected by a double washer and after the nut has been



turned home a piece is cut-out as shown in figs. and bent up, thus locking the nut.

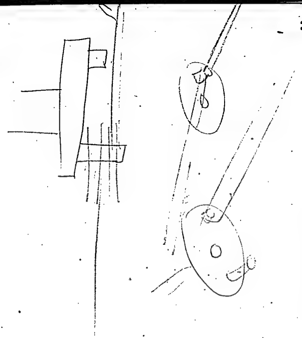


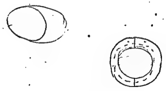
The same arrangement is to be on the bolt-heads on opposite side.

Electric locomotive, July 23 1880

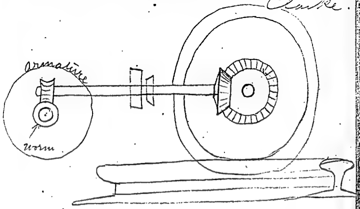
Same size as the 120 H.P. dynamo-electric machine, Clarke.

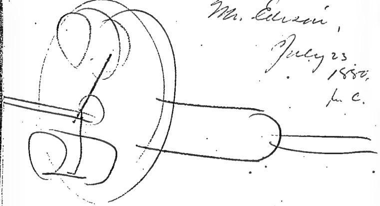
Weight of Fields	3 324 lbs.
Brass Field Plate	300 lbs.
6 Cores	3108 lbs.
Copper wire	804 lbs.
Heads	2160 lbs.
Armature without shaft	2487 lbs.
	12183 lbs.





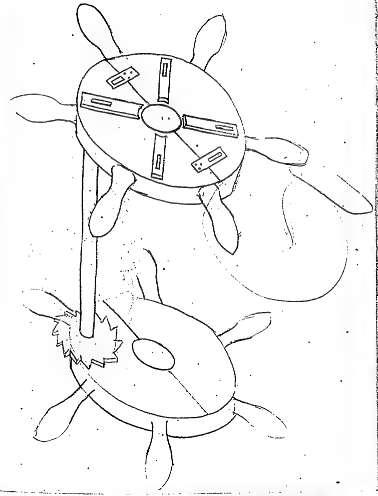
Electric locomotive. July 23,
1880.
Clarke.

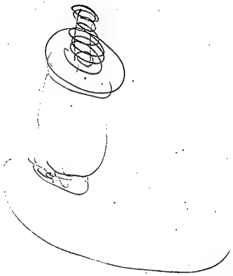




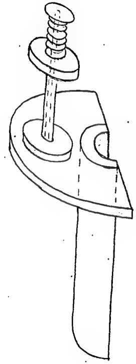
Mr. Edison,
July 23
1880,
J. C.

Sewing machine, · July 23, 1880. Clarke.

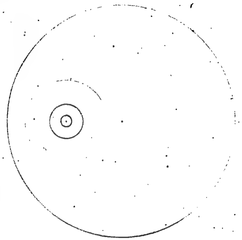


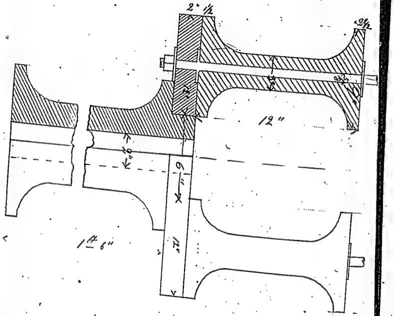


Sewing Machine, July 23, 1880,
Clarke.

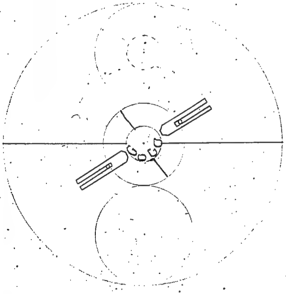


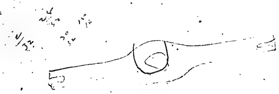
Sewing machine, July 23 1880, Clarke





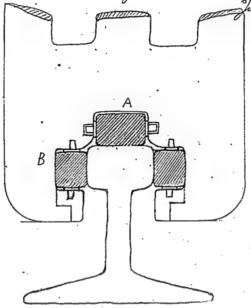
Sewing Machine. Scale 2in to 1ft. July 23 1880, Clarke.





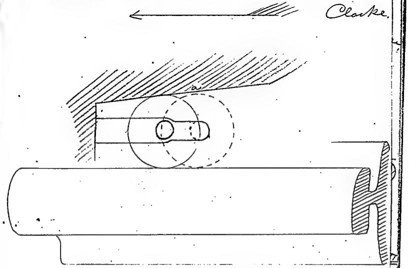
Roller clutch for climbers.

July 26, 1880
Clarke



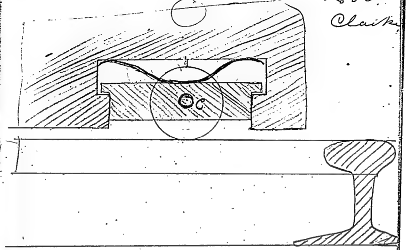
Cross-section showing the top roller which is simply to prevent sliding friction when clutch moves forward, Side rollers clutch

Clarke.



Plan of clutch rollers on side of rail head, showing the guiding groove for axle, which groove takes the axle after the pressure is off and prevents sliding friction at a: and also limits the play of the roller.

Roller clutch. July 26. 1880. Clarke



The anti-friction roller on top of rail. When the clutch rollers tighten and thus as a fulcrum would tend to bring a pressure on the axle C the spring allows the rail and shoe to come in direct contact with roller, thus preventing strain on C.

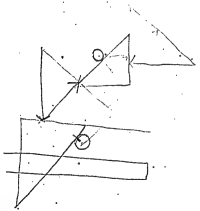
80 120

20 25

6

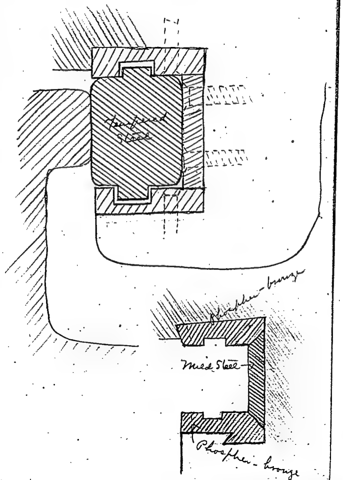
36 81

$$\begin{array}{r} 36 \\ 3 \\ \hline 1.08 \end{array} \qquad \begin{array}{r} 81 \\ 2 \\ \hline 162 \end{array}$$

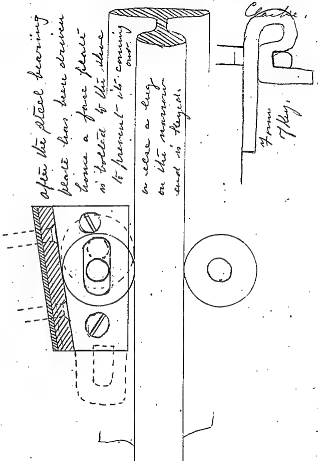


Roller clutch, July 26, 1880.

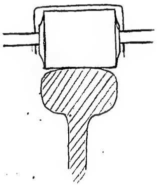
Clarke.



Roller clutch, July 26, 1880.

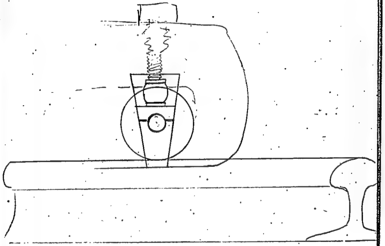


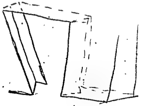
Roller clutch. July 26, 1880,
Clarke.



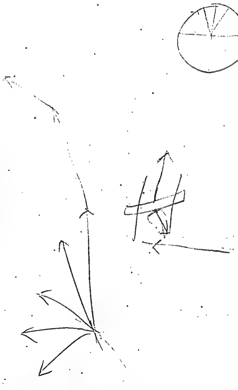
Roller clutch, July 26, 1880

Clarke





3/16



Efficiency of the worm
on 1st geared locomotive July 2?, 1880
$1\frac{1}{2}$ pitch, $7\frac{1}{2}$ pitch diam. Clarke

$$\begin{array}{r} 3.14 \\ 7.5 \\ \hline 1570 \\ 2198 \\ \hline 23.550 \end{array}$$

$1.5\,)\,23.550\,(\,15.7$ nat. tan. of θ

$$\begin{array}{r} 15 \\ \hline 85 \\ 75 \\ \hline 105 \\ 105 \\ \hline \end{array}$$

Angle $86^\circ\ 21'$

$3^\circ\ 40$

$\theta - \varphi = 86^\circ\ 21' - 4^\circ\ 18' = 82^\circ\ 3'$

$\dfrac{1}{\tan.\theta} = .0636$

$15.7\,)\,1.00000\,(\,.0636$

$$\begin{array}{r} 942 \\ \hline 580 \\ 471 \\ \hline 1090 \\ 942 \\ \hline \end{array}$$

$\dfrac{1}{\tan.(\theta-\varphi)} = .1396$

$7.1607\,)\,1.00000\,(\,.1396$

$$\begin{array}{r} 71607 \\ \hline 283930 \\ 214821 \\ \hline 691090 \\ 644463 \\ \hline 466270 \end{array}$$

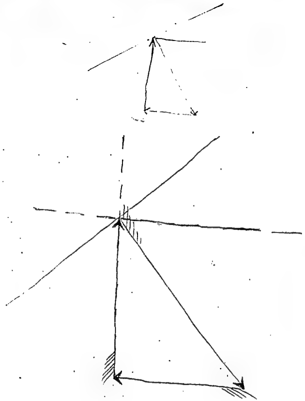
$\dfrac{\tan\theta}{\tan(\theta-\varphi)} =$

$7.1607\,)\,15.7000\,(\,2.1925$

$$\begin{array}{r} 143214 \\ \hline 137860 \\ 71607 \\ \hline 662530 \\ 644463 \\ \hline 180670 \\ 143214 \\ \hline 374560 \\ 358035 \\ \hline \end{array}$$

2.1925 is the Counter efficiency

See Engineering Vol. XIX, No. 473. pages 73 & 74. Jan. 22. 1875



This is upon the assumption that the angle of friction is 4°18' or, its tang. and coeff. of friction are .075.

If we suppose the coeff. to be only .05 the angle of which is 2°52'.

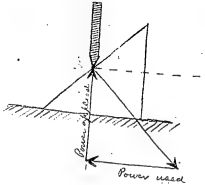
then $\theta - \varphi = 86°21' - 2°52' = 83°29'$

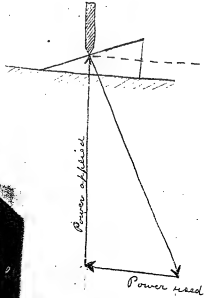
$$\therefore \frac{\tan\theta}{\tan(\theta-\varphi)} = \frac{15.7}{8.754} =$$

```
8.754) 15.700 (1.7935
        8 754
        69460
        61278
         81820
         78786
          30340
          26262
           40780
```

1.7935 is Counter efficiency.

1.47) 1000(.70
1.79) 1000(.60



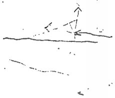


In unusually favorably the coeff. of friction has been (Rankine) as low as .03

angle of .03 = $1°43'$

then $A - \varphi = 86°21' - 1°43' = 84°38'$

$\therefore \dfrac{\tan A}{\tan(A-\varphi)} = \dfrac{15.7}{10.65} =$



```
10.65) 15.70(1.474
       10 65
        5050
        4260
         7900
         7455
          4450
          4260
           1900
```

Counter efficiency

when coeff. of friction is .03
1.474

When coeff. of friction is .05
1.7935

When coeff. of friction is .075
2.1925

$\sqrt{1.0009}$ 1.0004

$1.0309)\ 23.5500\ (22.8$

20618

29320

20618

87020

$\sqrt{1.0025}$ (1.00125

$1.0525)\ 23.5500\ (22.4$

$\sqrt{1.005625}$ (1.0028

.075

1.0778

$1.0778)\ 23.5500\ (21.8$

21556

19940

10778

91620

If p = pitch

r = radius of pitch circle

f = coeff. of friction

then the counter efficiency will be least possible when

$$p = \frac{2\pi r}{f + \sqrt{1+f^2}}.$$

The economical angle is given by formula

$$\tan\theta = \tan\varphi + \sqrt{1+\tan^2\varphi}$$

where θ is the angle which thread makes with axis of screw and φ is the angle of repose.

Since in present case $2\pi r = 23.55$

When $f = .03$

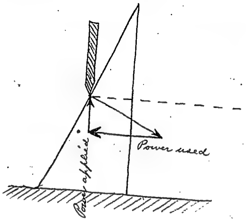
$$p = \frac{23.55}{.03 + \sqrt{1+.0009}} = \frac{23.55}{1.0309} = 22.8$$

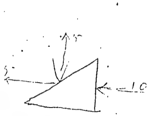
When $f = .05$

$$p = \frac{23.55}{.05 + \sqrt{1+.0025}} = \frac{23.55}{1.0525} = 22.4$$

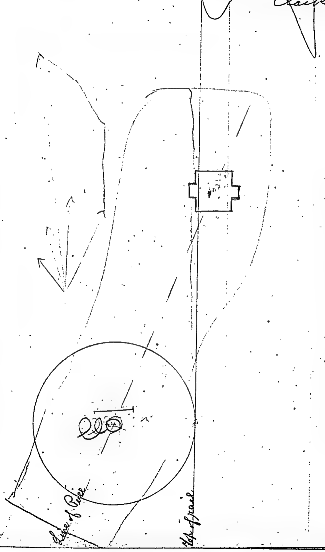
When $f = .075$

$$p = \frac{23.55}{.075 + \sqrt{1+.005625}} = \frac{23.55}{1.0778} = 21.8.$$





Roller clutch, July 27, 1880.
Clarke.



14" dynamo machine

Diam, of iron plates 14".

51 Commutators.

102 notches.

404 turns.

.431" to 1 notch.
.030" for peg.
.401" for wire.

4 wires in each notch side by side.

Each wire .100" diam. including covering.

.013 allow for covering.

Actual diam. of wire .087".

Contains 7570 circular mils.

And 8 contain 60560 c. mils.

Dimensions of Armature

$9\overline{)5.4}$ .6 .8 .48 $4\overline{)3.6}$ .9

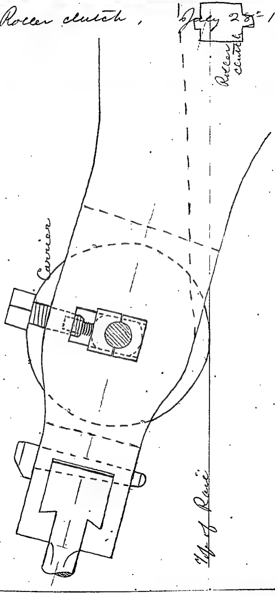
Armature 20" long.
14" diam.
34"
2
68" Distance around
6" for ends
74" Total
102 turns
148
74
12)7548 Inches of wire
4)629 feet "
157.2

Resistance of machine .0244 ohms

Dimensions of Armature.

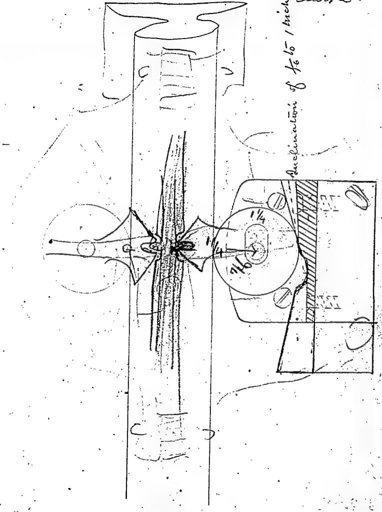
Roller clutch, July 28th 1880.

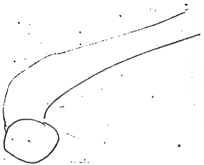
Clarke



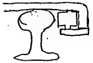
Roller clutch, July 28, 1880

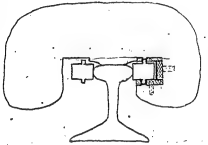
Clarke.

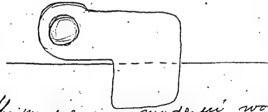




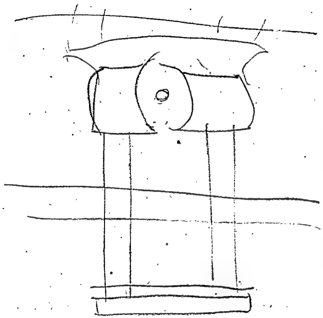
Roller Clutch, July 28, 1880,
Clarke



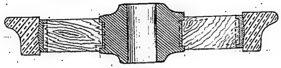




The model was made in wood by John Ott and tested July 29th 1880. Worked very satisfactorily.

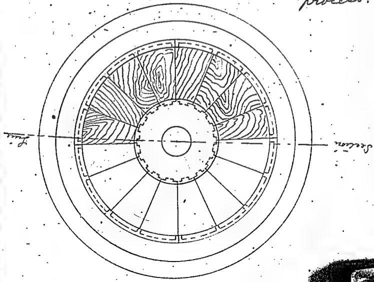


Electric locomotive.
Insulated car wheel July 29, 1880,
Clarke.



See page 89.

Why not use wood
treated by the resin
process?

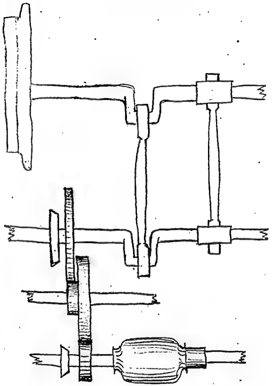


Electric Railway, July 30, 1880,
Clarke.

Instead of having the motion gear directly into a spur wheel on the driving wheel axle (for then we cannot place the locomotive on springs and must have everything rigid, which will strain all the parts and must frequently break the axles) I propose to gear to an intermediate shaft and connect this shaft with driving wheel shaft by connecting rod and thus take up the motion. and place locomotive upon springs

over

Electric Railway. July 30, 1880.
Clarke.

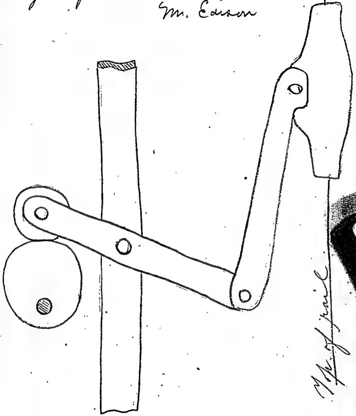


Two rods at right angles
may be used as in fig.

Electric Railway; July 30, 1880.

Clarke.

Cam gear for creeper
Wm. Edison

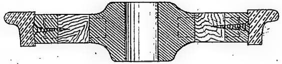


How is this to be brought-back excepting by a spring?

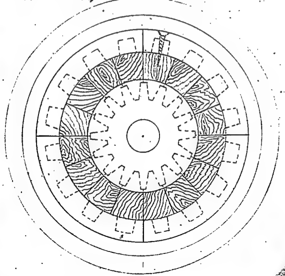
See page 93

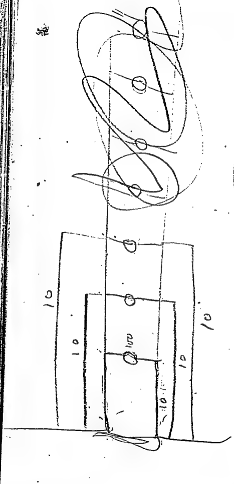
Electric Railway, July 30, 1880.

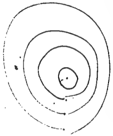
Insulated Car wheel, Clarke,

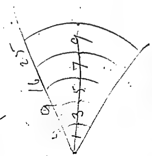


Allow a clearance between each mortice and tenant. See page 81
Wood screws or dowels driven into wooden spokes.





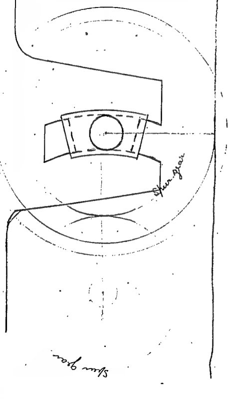




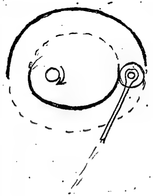
Electric railway, July 30, 1880.

Clarke.

Compensating guide for driving wheel journal.



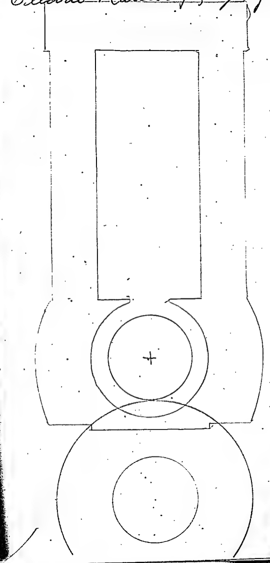
Electric Railway. July 30th 1880.
Clarke.
See page 87.



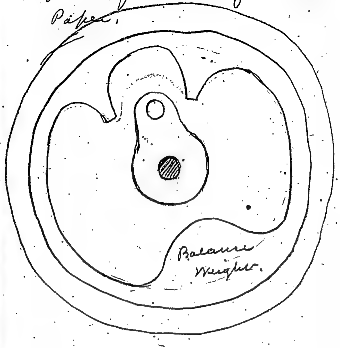
By having an inside and outside arm the creeper can be pushed forward & doing away with the spring.

Electric Railway, July 3/21 1880

Clarke



Electric Railway. Aug 2, 1880.
Driving wheel of Paper. Clarke



3.14
2.6
1884
628
8.164
224.2
16328
32656
16328
16328
1830368

224.2) 1884.0 (8.4
1793 6
9040
8968
720

3.14) 8.40 (2.7
628
2120
1884
2360

Weight of armature with copper 2500 lbs.

Aug. 2. 1880
Clarke

Fields 3324 lbs.
Cores 3108 lbs.
Wire 800 lbs.
Heads 2160 lbs.
11900 lbs.

---

5 3.14
15.70

5280
2
3)10560
15.7)3520.0(224.2 turns of driver
3144
380
314
660
628
320

40 m. per h
" 2/3 m. per min.

40 miles per hour

Wheel on armature shaft 1' diam.
600 revo. per m.
Circum. 3.14 ft.
Circum. velocity 1884 feet per m.

Spur on driving wheel
diam. 2.6 ft.
Revo. per mile 224.2
Circum. 8.16 ft.
Circum. velocity 1830 ft. per m.

If a maximum of 200 H.P. is ever required at 40 miles per hour.

We have 6600000 ft. lbs. per minute.

Speed 3520 ft. per m.

Therefore pressure on teeth of spur wheel at armature

3520)6600000(1875
3520
30800
28160
26400
24640
17600
17600

= 1875 lbs.

If same H.P. is developed at speed of ten miles per hour we have speed per minute $= \frac{5280}{6} = 880$ ft, and pressure on spur wheel is

880)6600000(7500
6160
4400
4400

= 7500 lbs.

We will then consider
10 000 as the greatest strain
coming on the teeth of the
spur wheel on armature shaft.
According to Tredgold the stress
should never be greater than
4500 lbs. per sq. in. of
section across the tooth

and the tooth should
be broad enough across
the face for the same reason.
This is for cast-iron
If then we make the gears of
steel we certainly can assume
2½ sq. in. as safe.

36) 37.6992 (1.0472
36
169
144
259
252
72

24) 37.6992 (15
24
136
120

3.1416
15
157080
31416
47.1240

36) 47.124 (1.31
36
111
108
32

12 : 21 :: x : 31

31
12
21) 372 (18
21
162

21
3
63

31
3
93

93 : 600 :: 63 : 600
93) 37800 (406
372
600

Diam. of gear 1 ft
Circum. 3.1416 ft.

If Three pitch then
36 teeth
Circum. pitch = 1.0472"
Will not give cross-section enough

If 2 pitch then
24 teeth
Circum. pitch = 1.5
Not cross-section enough.

Diam. of gear 15 in
Circum. 47.124 in

If 3 pitch then
36 teeth
Circum. pitch =

Not applicable

3.1416
1.5
157080
31416
4.71240

5 6.8
36) 56.8 (1.58
36
208
180
280
288

1.5
.75
.225

7 x 12. = 84

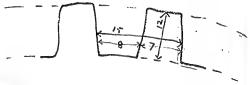
84 : 225 :: 2.5 : 6.7

15
12
180

225
2.5
1125
450
84) 562.5 (6.7
504
585
588

6.70 (2
4

1.5 .75
2.0 - 3 5

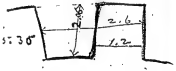


~~7 : 15 :: 2.5 :~~

84 : 180 :: 2.5 : 5.36

25
2
2
7) 37.5
5.

180
2
360
90
84) 450 (5.36
420
300
252
480
420
600



7 : 84 :: x : 2.5

7 : $\sqrt{84}$ :: x : $\sqrt{2.5}$

2
42
168
7) 210

2.5
7
84) 17.5 (.21
168
70

9.17

1.58
9.17) 11.06 (1.2
917
1890
1834

2.5
12
84) 30.0 (.357
252
480
420
600

1.2 : 7 :: x : 12

7) 14.4
2.06

If armature be increased to 31 inches and gear to 1'6"

Then when

3 pitch  

54 teeth

Circum. pitch Circum 4.7 ft = 56.8"

= 1.~~5~~

2 pitch
36 teeth.

The pitch in order to get a tooth of the proper cross section should have Circum. pitch of 2.6", which means a width of tooth 1.2 and height 2.06 giving cross-section of 2.47 sq. in.

2.06
1.2
412
206
2.472

1.2 : 7 :: x : 15
15
7) 13.0
2.1

~~..~~ If we assume 2 sq. in. for steel

1.414
9.17) 9.898 (1.0
917
7250

1.414
15
7070
1414
9.17) 21.210 (2.3
1834
2870

1.414
9.17) 16.968 (1.85
917
7798
7336
4620

15123;;42

42
23
126
84
15) 966 (64
5" 4"

18
2512
314
23) 56.52. 24.5
105
132

24

3.14
1.5
1570
314
21) 47.10 (2.243
42
51
42
90
84
60

18) 47.10 (2.62
36
110
30

~~Pitch 2.3".~~
~~Diam 18"~~
~~2 Pitch~~
~~Teeth 36~~

3.1416
18
251328
31416
565488

Diam 20"
2 Pitch
Teeth 40

3.1416
20
62.8320

Diam 24"
2 Pitch
Teeth 48"

3.1416
48
251328
125664
48) 150.7968
75.

Diam
18"
3.1416

3.14
1.5
1570
314
4.710
2.3) 56.4 (24
46
104
92

18) 34 (1
60

3.1416
18
251328
31416
56.5488

3.1416
16
188496
31416
24) 50.2656 (2.0
48
22

3.1416
14
125664
31416
21) 43.9824

3.1416
1.5

16
1.5
80
16
24.0

1.8
1.5
90
18
27.0

1.5
1.6
9.0
15
24.0

14
1.5
70
14
21.0

18.25
1.8
600

1.5
1.2
30
15
15.0

17.5

15
1.4
60
15
21.0

600
12
15)720 0(450
60
120
120

21
15
105
12)315(26¼
24
75
72
30

3.14
314
628
65.94
39564.00

3.14
26¼
1884
628
785
82.425
412125
329700
3709125

450)39564(87.92
3600
3564
3150
4140
4050
900
900

3.14)87.92(28
628
2512
2512

3.1416
18
251328
31416
24)56.5488(2.356
48
85
72
134
120
148
144

18

Aug 3, 1880.

23
2.4
92
46

3.1416)55.2000(17.5
31416
237840
219912
179280

15)24.0(1.3
15
90
54

1.3)24.0(18.5
13
110
104
60
65

18.5
1.4
740
185
2590

15)27.0(1
15
90

18.2
1.5
900
182
273

18.5)26(1.40
185
750
740
100

15" spur. 1.2 diam. pitch.
18 teeth. 2.6 circum. pitch.
Armature 21" diam. at 600 revo.
with spur of 12"
~~15" : 12" :: 600 : 750 Revo. per min~~
~~wit 12 : 15 :: 21 : 26¼ diam of armature~~

3.14
15
1570
314
47.1

1800
12
21600

21600.0(458.6 revs. to give
1884
2760
2355
4050
3768
2820
2826

1800 ft. circum. velocity per m. in 15" spur.

3.14
21
314
628
65.94
600 revs.

revs.
458.6)39564.00(86.27 circum. of armature to make 458.6 revs.
36688
28760
27516
12440
9172
32680
32102

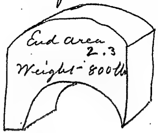
3.14) 86.27(27.4
628
2347
2198
1490
1256
2340

27 3/8

27 3/8 diam of armature to make 458.6 revs.

See Book 72 First Series
pages 186 to 194. Aug 3, 1880

Motor for Locomotive.

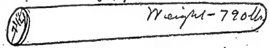


One magnet field.

Weight of
6 = 4800 lbs.

2.3
.77
161
161
1.771
450 lbs.
88550
7084
796.950 lbs.

27" Dynamo.



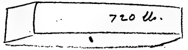
~~2.75~~ $3\frac{9}{12} = \frac{45}{12 \times 12} = \frac{45}{144}$

144)45.0(.3125
43.2
180
144
360
288
720
720

.3125
.3125
15625
6250
3125
9375
.09765625
3.14
39060
9765
29296
.30664062
153320
102213
1.536149

1.636
480
130880
6544
785.280

Weight of 6 = 4740 lbs.



Weight of 3 = 2160

3.5 : 5.33 :: 133.7 : 204

6685
446
3.5) 7131 (204
70

Copper wire on each core
200 lbs.
6 cores = 1200 lbs.
Cores & copper 5940 lbs.

Armature for $20\frac{1}{2}$ magnet weighs 2187. Plates are 20." diam.

Now for 27" diam

$\overline{20}^2 : \overline{27}^2 :: 2187 : 3986$ lbs.

27
27
189
54
729

2187
729
19683
4374
15309
400) 1594323
3986

Weight of Armature Plates
3400 lbs.

19000
5
95000
10

50
10
500

Suppose copper (300 lbs) to increase in same ratio.

400 : 729 :: 300

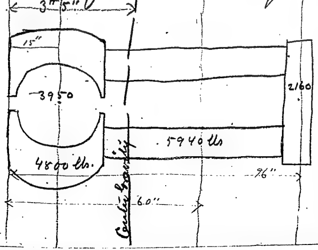
729
300
400) 218700
547

Copper on Armature 550 lbs.

Armature + Copper without shaft 3950 lbs.

Center of Gravity

32
24



64
24
8
96

4800
3950
8750
15
43750
8750
131250

4800
3950
5940
2160
16850

131250
356400
207360

16850)695018(41.
6740x
2101
1685
4160

41 inches = 3 ft 5"

5940
60
356400

2160
96
12960
19440
207360

See page 113 Revo. per minute of 5 ft- driver at 40 miles per hour is 224.2 and at 1800 feet speed of gearing or 21600 inches the circumference of wheel should be

224.2)21600.0(96.343 inches on circumference
20178x
14220
13452
7680
6726
9540
8964
5720
4484
12360

$$\begin{array}{r} 25 \\ 1.2 \\ \hline 50 \\ 25 \\ \hline 30.0 \end{array}$$

3.1416) 96.3436 (30.7 inches
94.248
209560 is diameter
of spur.

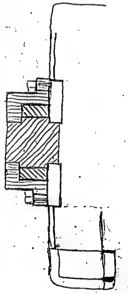
1.2 was diam. pitch of
Spur on armature shaft

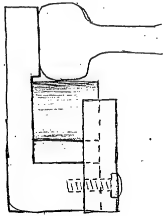
$$\begin{array}{r} 30.7 \\ 1.2 \\ \hline 36.84 \end{array} \qquad \begin{array}{r} 30 \\ 1.2 \\ \hline 36.0 \end{array}$$ teeth and
spur on driving wheel
30" diam.

		2	500	
	2			175
		4	675	
	3			
		7	850	175
	4			
2		11		350
				525
3	5			850
		16		1375
125	6			
		22		
	7			

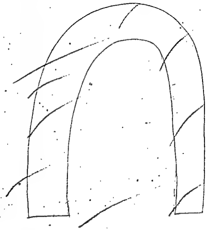
Aug. 1880.

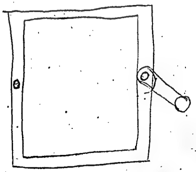
Clutch. Clarke.





Reversing gear for clutch, Clarke, Aug. 9, 1880,





2 | 3.1416
1.5708
4
Length of middle line 5.5708
.02
.111416

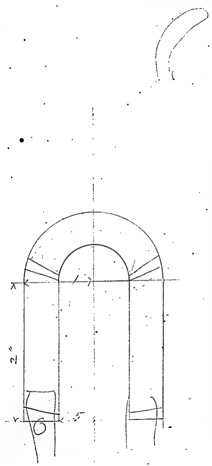
3.1416
Length 17.
Intersection .14 .22

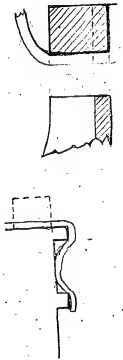
5.5708 : 7.1416 :: .111416

7.1416
.111416
428496
71416
28564
71416
71416
71416
5.5708) .795688506 (.142
55708
238648
222832
15772

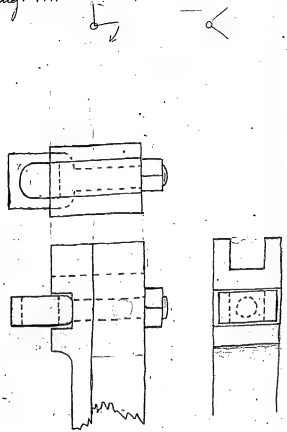
5.5708
.111416
3.14) .459384 (.174
314
2379
2198
1213

7.1416
.142832
3.14) .699876 (.223
628
718
628
907





Aug. 12, 1880.



10,64
305733) .00425600 (.0000000137
305733
1198670
917199
2814710

.000000014 ohm

and if solder be 12 times as great resistance we have .000000014
12
.000000168 ohm. and
for 138 connections 138
1344
504
168
.000023184 ohm

~~Internal~~ Oct. 4th Clarke

Resistance of conductor of Copper .24" × 1" and $\frac{1}{500}$" long.

$R = \frac{10,64\,l}{m}$, where l = length in feet and m = circular mils,

1 circular mil = $.0005^2 \times 3.14$ = .000000785

3.14
.00000025
1570
628
.0000007850

.000000785) .24000000 (305733
2355
4500
3925
5750
5495
2550
2355
1950

There are 305733 circular mils in this section .24 × 1.

Length is .005" or .0004 ft

hence $R = \frac{10.64 \times .0004}{305733} =$

Resistance from solder .0000232 ohm

140
5600
140
.31) [illegible]

28009118
.0000232
56018236
84027354
84018236
56018 ... 1537 6 (2096

.31) 649.84
62
298
279
171

If resistance be 30 to 1 and internal is .01 ohm. then external is .3 ohm and total .31 ohms. with 140 volts on .31 ohms we have

$\frac{\overline{140}^2}{R} \times 44.3 = 28009118$ ft-lbs.
= 85 H.P.

Now of the total 28009118 ft-lbs.

$\frac{.0000232}{.31}$ is due to ^sep^ soldering

= 2096 ft-lbs.

If soldering be 1/1000 deep instead of 5/1000 then the loss is 424 ft-lbs

= 1/80 H.P.

1/40

16 48

186° 215°

16

110 Volts

)26.1) 175.0 (6.7
156.6
1540

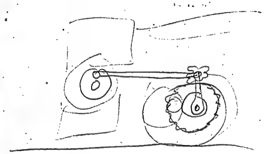
39) 175.(2

6567
.55
32835
32835
3611.85
2278
5890.
71.5
29450
5890
41230
33000) 421.135.0 (12.76 H.P.
33
91
66
251
231
203

.34
6700
23800
204
2278.00

1.43
6700
100100
858
9581.00
6567
1.35
32835
19701
6567
8865.45
9581.
18446
69.5
92230
166014
110676
33000) 1281.997.0 (38.85
99
291
264
279
264
159

38.85
12.76
26.1 H.P.



140
.675
700
980
840
94.500

95 Volts at 950 revs. for

$\frac{14}{100}$ machine.

.28 2.8 ohms to circuit

of which 2.52 is Counter E.M.F.

95
95
475
855
9025
44.3
27075
36100
36100
2.8) 399807.5 (140000
28 X
119
112

33000
33000
66000

~~90~~
66 ~~000~~) 399. ~~80775~~ (6
396

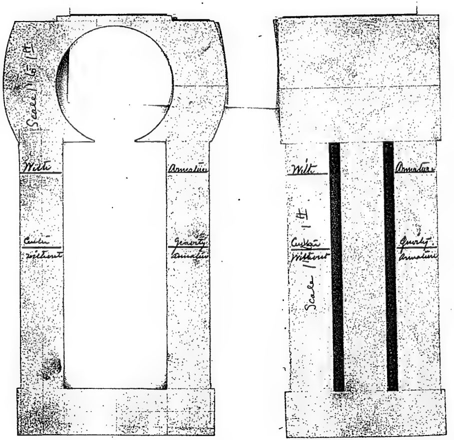
$\frac{9}{10}$ of 140000 = 126000
16000
110000 outside

140000
16000
156000 consumed

11 ~~000~~
156 ~~000~~

156) 110.000 (712
109 2
1 80
1 56
240

[ITEM FOUND IN BOOK]



Menlo Park Notebook #116 [N-80-07-27]

This notebook covers the period July-November 1880. The entries are by Charles L. Clarke. The book contains calculations, notes, and drawings relating to dynamos and steam engines for the jumbo dynamo. There are also tests of dynamos and motors, using meters with depositing plates to measure the current, and tests of the insulation for the electric railroad track. The label on the front cover is marked "C. L. Clarke." The book contains 284 numbered pages.

Blank pages not filmed: 222-257, 262-274, 277.

Missing page numbers: 275-276.

xE-172 N-80-07-27

9 x 10

81
10
510 at 120 developers 100
120
16200
510
97200

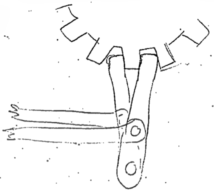
3,5 x 8
3,5
175
105
12,25
8
98~~00~~
.60
5880~~00~~
510
294000

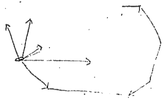
97200
600
58320000

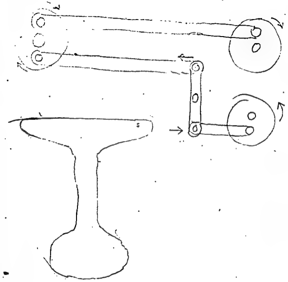
294000
100
58320~~00~~) 2940000000 (5
291500
5
25

Supt. of engineering 1
M. Hanes Manhattan
New York

60
12







Dynamo-electric Machine.

30 to 1 Resistance

75 lights

105 Volts at 600 revo.

2 Turns of 8 wires

Wire 87/100

armature

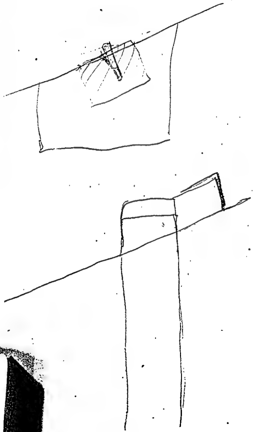
20 " long

14 " diam.

51 commutators.

Proportions for Dynamo.

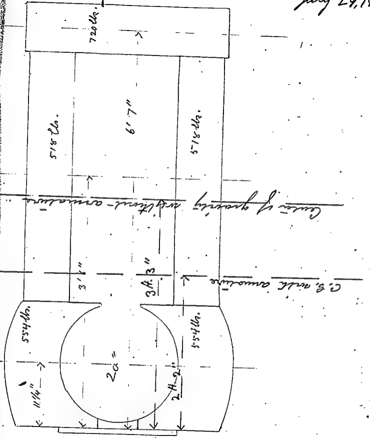
July 27, 1880



Determining Center of Gravity

20" Dynamo

July 29, 1880.



575
575
1036
42
2072
4144
43512

554
554
1108
11.25
5540
2216
1108
1108
1246500
56880
43512
2864)112857(39"
85927
26937   3'3"

79
720
1580
553
56880

720
1036
1108
2864

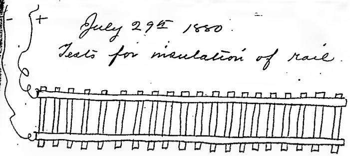
Weight of armature with shaft
some 2500 lbs.

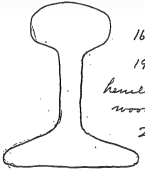
11.25
2500
562500
2250
2812500
112857
5364)140982(26 inches
107284
33702
32184   2 ft 2".

2864
2500
5364

July 29th 1880

Tests for insulation of rail





16 lb. rail.

19 sleepers of hemlock cord-wood.

24 ft. rail.

After being laid down upon a grass plot and spiked and allowed to remain a week, during which time there were heavy rains the resistance was measured. The grass was dry and sky clear. The resistance was 8900 ohms, as the spikes on one side were drawn the resistance rapidly increased.
And when all the spikes had been

drawn ~~and~~ on one side and that rail rested on the two end sleepers the resistance was:

290 000

When a man stood on the rail at each sleeper on the end,

220 000

When a middle sleeper was in contact also,

250 000.

When man touched it with his hand it was

100 000

When all the ties on that side were in contact but spikes drawn the resistance was 75000.

Spikes pulled on both sides and rails supported on end ties
and ties not well grounded
1600000.

Man standing on three points of support - 16 0000

One rail taken off sleepers and laid on ground, other rail supported on ends, and contact points and rail resting on ground wet,

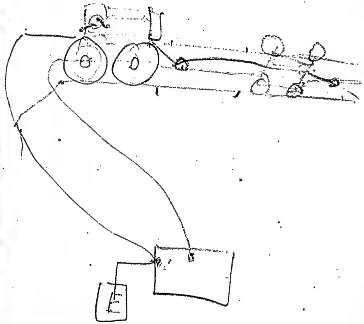
250 000

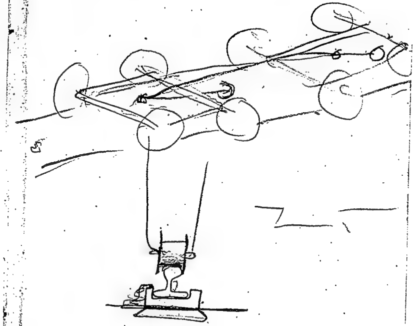
Rail wet on ground and other end of circuit grounded

450

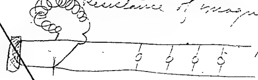
Again 100000

The grounding of the rails is the principal cause of fall in resistance and not directly through the ties as their resistance is very high.


E



Aug. 7, 1880



Resistance of magnet 30 ohms.

If 100 lamps are in circuit the resistance of circuit wire be $\frac{1}{10}$ ohm, therefore resistance of magnet is 3 ohms.

Then with 100 Volts at machine we have

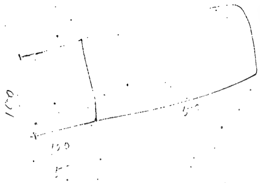
$\frac{1}{3} + \frac{10}{1} = \frac{31}{3}$ ∴ Resistance with magnet is $\frac{3}{31}$ ohms.

∴ $\frac{1}{10} : \frac{3}{31} :: 100 : 96.8$ Volts

$\frac{300 \times 10}{31}$

31)3000(96.8
279
210
186
240

a fall 3.2 Volts



Aug. 7, 1880.

Now supposing only 100 lamps in use.

The resistance of line will be 1 ohm.

$\therefore \frac{1}{3} + 1 = \frac{4}{3}$. therefore resistance of line including magnet will be $\frac{3}{4}$ ohm.

$\therefore 1 : \frac{3}{4} :: 100 : 75$

a fall of 25 Volts.

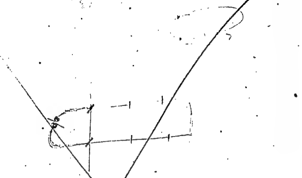
If only one lamp is in use, the resistance of line is 100 ohms and including magnet $\frac{300}{103}$ ohms.

$\therefore 100 : \frac{300}{103} :: 100 : 2.9$

a fall of 97.1 Volts.

$\frac{1}{2} + \frac{1}{30}$ $\frac{16}{30}$

$\frac{16}{30} : \frac{15}{30}$



100 lamps. 106

30 to 1 30 to 1

1 ohm $\frac{100}{106}$ ohm

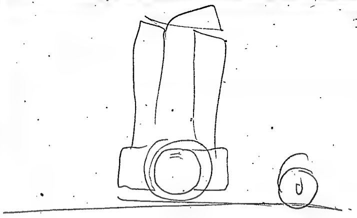
$\frac{1}{30}$ ohm $\frac{100}{106} + \frac{1}{30}$

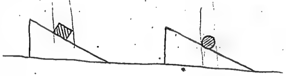
$\frac{31}{30} : \frac{30}{30}$ 3000 / 106

$\frac{3106}{3180}$: 3180

31) 3000 (96.8 3180) 3106 00 (97.

279 / 210 / 186 / 240 2862 / 2440 / 2226 / 2140



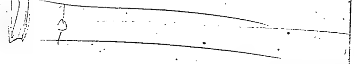


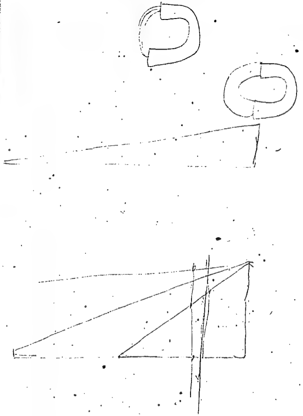
$\frac{100}{106} + \frac{1}{30} = \frac{3000 + 106}{3180} = \frac{3106}{3180}$

$\frac{3106}{3180} : \frac{3180}{3180}$

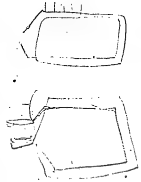
3.106) 300000 (96.6

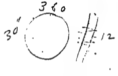
27954 / 20460 / 18636 / 18240



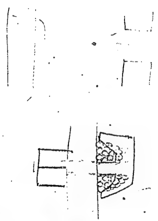


772) 165000 (214
1544
1060
772
2880





$\frac{30}{23}$



Basis Experimental

Aug. 11, 1880.

100 revo. give 8 volts with 75 turns. 19½" armature. 75 commutator blocks.

at 600 revo. 48 volts.

If ~~armature~~ 3 times as long will give 144 volts.

115 Volts will run present lamps. $9\frac{2}{10}$ per H.P.

About 135 Volts are required for the machine.

144 : 135 :: 75 com. to 70.3 com.

Since 71 and 73 are prime 69. Commutators are taken which will give 132 volts. 23

Calculation for Commutators

Diam. of plate 19.5"

69 turns or 138 divisions.

Circumference of 61.2".

138) 61.20 (.4435

552

600

552

480

414

660

4

.444" for each division.

.02" for peg and .02" for insulation

Say .05" for separation.

.444 − .05 = .394" for wire

Diam. of plate 19.5"

69 turns or 138 divisions.

Circumference of 61.2".

```
138) 61.20 (.4435
     55 2
      600
      552
       480
       414
        660
                4
```

.444" for each division.

.02" for peg and .02" for insulation

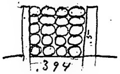
Say .05" for separation.

.444 − .05 = .394" for wire

Commutator Wire.

4, 5, 7, 8, 9, [illegible], 12; 13,
14, 16, 18, 20, 22.

Cross section of Wire



.009 on each wire for insulation

$\begin{array}{r} .394 \\ .036 \\ \hline .358 \end{array}$ $\begin{array}{r} .5 \\ .045 \\ \hline .455 \end{array}$

Actual space occupied by copper wire. .358" × .455"

$4\,\underline{\big)\,.358}$ $\underline{.455}$
.089 .111

Wire $\frac{9}{100}$" diam.

$\frac{9}{100}$ $\frac{81}{10000}$ or 8100 circular mils.

20 wires give
162,000 circular mils.
in section.

Length of armature
29".
Diam. at center of wire 20".
allow 5" for ends.
making 29+20+5 = 54" × 2 = 108"
or 9 ft of wire for complete turn. There are 69 comm.
69 × 9 = 621 ft of wire on machine, which has resistance of equivalent size and 1/4 the length or
155.2 ft.

Resistance of mil-foot —
10.64 Ohm.

Resistance of machine
= $\frac{10.64 \times 155.2}{162000}$

```
      155.2
      10.64
     ------
     6208
    9312
  1552
162~~000~~) 1651.328(.0102
            162 x x
            -------
              313
              324
```

Lamp 165 ohms.

Take 800 lamps

$\frac{165}{800}$ Ohms resistance

800.)165.(

.206 Ohm.

a ratio of .206 to .0102

or 20.6 to 1

at 132 Volts.

2) 3.1416
1.5

$\overline{132}^2 : \overline{115}^2 :: .0102 :$

115
115
575
115
115
13225
.102
26450
13225
17424) 1348950 (.00774 Ohms.
121968
129270
121968
73020

132
132
264
396
132
17424

.206 : .00774 :: 26.651.

.00774) 20.600 (26.6
1548
5120
4644
4760

Aug. 11, 1880.

Size of commutator block
on circle 8¼" diam.
69 Blocks

$$\begin{array}{r} 3.1416 \\ \underline{8.25} \\ 157080 \\ 62832 \\ \underline{251328} \\ 25.9182\cancel{00} \end{array}$$

inches circum.

allow 1/16" insulation

$$\begin{array}{r} 69)\ 25.9182\ (.3756 \\ \underline{207} \\ 521 \\ \underline{483} \\ 388 \\ \underline{345} \\ 432 \\ \underline{414} \end{array}$$

$$\tfrac{1}{16} = 16)\ 1.00\ (.0625 \quad \begin{array}{r} \underline{96} \\ 40 \\ \underline{32} \\ 80 \\ 80 \end{array}$$

$$\begin{array}{r} .3756 \\ \underline{.0625} \\ .3131 \end{array}$$

Outside diam. 10 1/4".

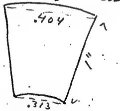
$$
\begin{array}{r}
3.1416 \\
\times\ 10.25 \\
\hline
157080 \\
62832 \\
31416 \\
\end{array}
$$

$$
69 \,\overline{)\,32.201400}\,(.4667
$$

$$
\begin{array}{r}
27\ 6 \\
\hline
4\ 60 \\
4\ 14 \\
\hline
461 \\
414 \\
\hline
474 \\
\end{array}
$$

$$
\begin{array}{r}
.4667 \\
-\ .0625 \\
\hline
.4042 \\
\end{array}
$$

5 1/8 radius



4 1/8 radius

3.1416
16
188496
31416
69) 50.26656 (.7285
48 3
196
138
585
552
336

.729

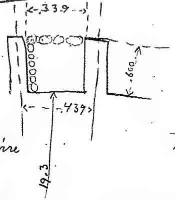
31416
49.5
157080
282744
31416
61.26120

.729
.0625
.6665

3.1416 Drain
19.3
94248
282744
31416
138) 60.63288 (.439
552
543
414
1293
1242

20.5
19.3
2) 1.2
.6

.439
.100
.339



7/100 drain of wire

25
4900
25200
112
137200

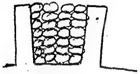
80
80
.6400

28
6400
11200
168
179200

If $\frac{9}{100}$ diam. including insulation $9 \times 4 = 36$

$.439 - .36 = .079 = \frac{8}{100}$

separation.

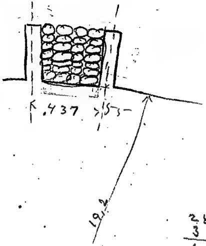


7

$3\frac{17}{32}$

.10

200000



20.5
19.2
2)1.3
.65
.7

3.1416
19.2
62832
282744
31416
60.31872

138) 60.31872 (.437
552
511
414
978
966

Wires $\frac{8}{100}$ diam. or $\frac{9}{100}$ with insulation.

.437 - .36 = .077 for separation

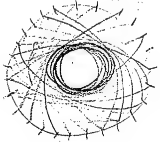
6400
11200
168
179.200 Circular mils.

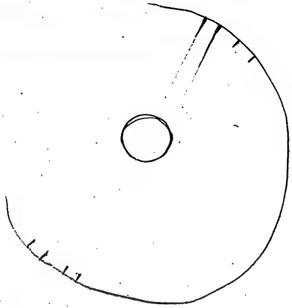
179200 : 162000 :: .0102 :

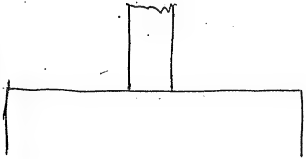
.0102
162000
204000
612
102
179200) 1652.4000 (.00922
16128
3960
3584
3760

.206 to .00922

or .00922) .20600 (22.
1844
2160
1844
3160







$9\frac{1}{4}$
$3\frac{1}{2}$

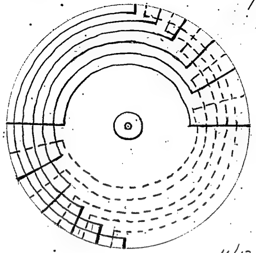
19) 5.757 (.303
5.7 ×
5 0

3.5
.301

.0625
.031

3.5
.303
3.107
.03121
3.22525

.303
.0625
.2405



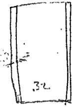
4) 138
$34\frac{1}{2}$

3.1416
$104\frac{1}{4}$
31.4160
7854
2) 32.2014
16.1

$3.1416\frac{1}{2}$
$3\frac{1}{2}$
94248
15708
2) 10.9956
5.5

20.5
7
13.5

.433
.32
.113
.11
.013



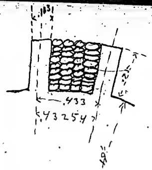
32) 23.0 (.71875

.32
.33

.11

19) 5.71875 (.301

Aug. 23
1880.



3.1416
19.
282744
31416
59.6904

138) 59.6904 (.4325

113 : 320

.433
.113

8 ⌊.433 . .75
. 4 + .113 . .9 + .03

4 by 9 wire $\frac{8}{100}$" diam. with insulation or $\frac{7}{100}$ of copper.

746
4900

36
4900
32400
144
176400

744
690
540
452

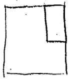
176400 : 162000 :: .0102 :

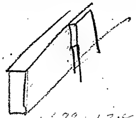
.0102
162000
204000
612
102

176400) 165240 (.0093
158760
6480
5292

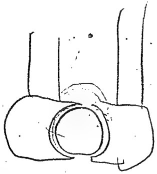
,0093) .2060 (.22

22.51 with lamps at 165 ohms.





.177).1385(.46
1196
1890



.24).1385(.5
120
8

.24).1385(.58
1207
185
192

5/10

5/8 .62

4)138(69
34½

Aug. 23, 1880

176400 circular mils

176400(420/1000 diam.
16
82)164
164

1000
1000
1,000,000

Radius = 21/100

.21
.21
21
42
.0441

3.1416
.0441
31416
125664
125664

.13854456 sq. inches

is the end area of each bundle of wire in copper.

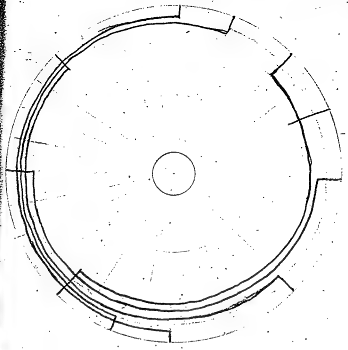
42
42
84
168
1764

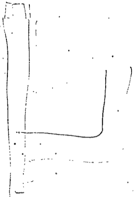
3.1416
6
2)18.8496
34.5)9.4248(.273).1385(.5
6900
2524
2415
1098

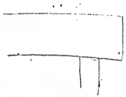
.25).13854(.55
1250
135
125

.5).139(.28
10
39

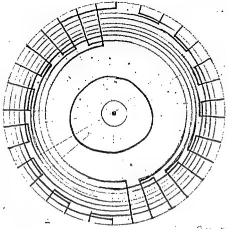
.525).1155(.22
1050
1050







End connections
for armature coils. Aug. 23, 1880.
Clarke,



$1\frac{1}{2}$

34) 5.0 (.147

6

6 / 138
23
46

2 / 34
17

12) 6.00 (.3000
.0625
.2375

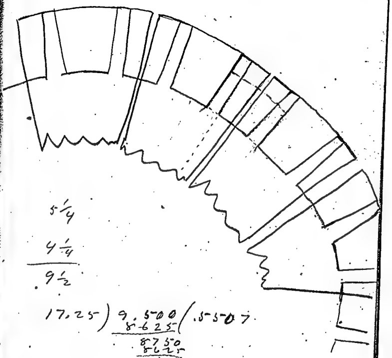
$5.25 : 5.25 + 4.25 :: x : 69$

$$\begin{array}{r} 5.25 \\ 69 \\ \hline 4725 \\ 3150 \\ \hline \end{array}$$

$$9.5\overline{)362.25}\,(38.1$$
$$\begin{array}{r} 285 \\ \hline 772 \\ 760 \\ \hline 105 \\ 95 \\ \hline \end{array}$$

Clarke.

$$\begin{array}{l} 2\overline{)138} \\ 4\overline{)69.} \\ \quad 17\tfrac{1}{4} \end{array}$$



$5\tfrac{1}{4}$

$4\tfrac{1}{4}$

$9\tfrac{1}{2}$

$$17.25\overline{)9.500}\,(.5507$$
$$\begin{array}{r} 8625 \\ \hline 8750 \\ 8625 \\ \hline 12500 \\ 12075 \\ \hline \end{array}$$

$\frac{1}{16} =$

$$\begin{array}{r} .5507 \\ .0625 \\ \hline .4882 \end{array}$$

$3\frac{1}{2}$
$5\frac{3}{4}$
$9\frac{1}{4} - \frac{1}{32}$

$9\frac{8}{32} - \frac{1}{32} = 9\frac{7}{32}$

$\frac{39}{17}$ $\frac{22}{32} = \frac{11}{16}$

.0625
18
5000
625
1.1250

$9\frac{7}{32}$
$3\frac{12}{32}$
$5\frac{11}{16}$

16) 11.0 (.6875
96
140
128
120
112
80
80

19) 5.6875 (.29934 2
38
188
171
177
171
65
57
80
76
40
38

.0625

5.6875
1.125
19) 4.5625 (.240
38
76

17) 5.0 (.3
51

.3) .1385
.46

19) 5.25 (.2763
38
145
133
120
114
60
57

.2763
.0625
.2138 is width of copper rings on 19 side

.2138) .138544 (.65
.128284
10264
10190

The height is .65 ".

16) 4.25 (.2669
32
105
96
109
140

.2669
.0625
.2044 is width on $15\frac{1}{2}$ side.

.2044) .138544 (.677
122664
15904
14308
15960

The height is .68

4 | 69
17 1/4

18 } 36
17 } 34

18 and 18
17 and 16

18) 5.75 (.32 distance between
5 4
35
36

Centers of strips

.32
1/16 = .0625
.2575 is width of

Copper rings on 18 side.

17) 5.75 (.34 distance between
5 1
65
68
Centers of strips.

.34
1/16 = .0625
.2775 is width of

copper rings on 17 side.

19) 5.75 (.303
57
50.
.0625
.2405

~~.7912~~

.7912
.20
2) .5912

3.1416
21.5
157080
31416
62832
69) 67.54440 (.9789
621 xx
544
483
614
552
620
621

.9789
.0625
.9164

.9789
1.5
48945
9789
2) 1.46835
.73418
.0625
.67168

69) 59.6904 (.8651
552 xxx
449
414
350
345
54

.8651
.0625
.8026

3.1416
20.5
157080
62832
69) 64.4028 (.93337
621 xxx
230
207
232
207
258
207
510

.93337
.0625
.87087

$3\frac{1}{2} + \frac{1}{32}$

$3\frac{16}{32} + \frac{1}{32}$

.236
.0625
.2985

.299342

$9\frac{3}{8}$
2
18.75

3.1416
18.75
157080
219912
251328
31416
69) 58.905 ~~000~~ (.8537
552 xx
370
345
255
207
480
483

.8537
.0625
.7912
.32
2) .4712
.2356

$10\frac{1}{4}$
$\frac{3}{4}$
$9\frac{1}{2}$

.7912
.32
2) .4712
.236

.53506
.0625
6) .47256
.07876
~~.8537~~

.8537
.64
2) .2137
.1.019

.8537
1.5
42685
8537
2) 1.28055
.64028
.64028
.236
.236
1.0625
1.81566

~~.8537~~
~~1.5~~

.64028
.0625
.57778

1.81506
1.28
6) .53506
.089

.578
.578

.7912
.0625
.578
.0625
.578
.0625
.7912

2.9159

32)17.0(.53125
16 0
100
96
40
32
80
64
160
160

.236
.32
.07876
.32
.07876
.32
.07876
.0625
.07876
.32
.07876
.32
.07876
.32
.236

2.92706

3.53125
.3615
3.16975

.0625
.299
.3615

3.53125
.3065

.0625
.244
.3065

$\frac{5}{8} \times \frac{3}{15} = \frac{15}{128}$

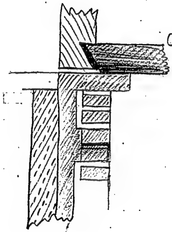
$10\frac{1}{8} =$

10.125
3.1416
60750
10125

Sept. 1, 1888.

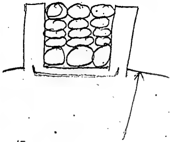
Commutator Side.

Clarke



Clarke

Sept 10, 1880.



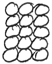
3 × 5

1.5 wires

$\frac{10}{100}$

.505

```
      3.1416
        19.5
    --------
     157080
    282744
    31416
    --------
138)61.2612(.443
    552xx
    -----
     606
     552
     ---
      541
      414
```



```
64)1.00(.015625
   .64
   ---
    360
    320
    ---
     400
     384
     ---
      160
      128
      ---
       320
       320
```

.015625
3
.046875

.5
.046875
.453125

1/.32

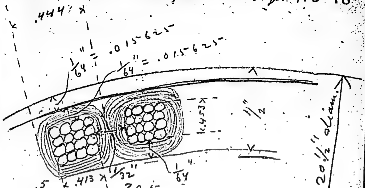
.047
.4
.3
.447
2)/.053
)/.026

.047
.020
.067
.4
.467

.5
.467
2 /.033
2 /.0165

36

.44/.000 = .22/.100



.5
.0313
.4687

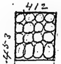
20.5
.9374
19.5126

.4687
.0156
.4531

3.1416
19.5
157080
282744
31416
138.)61.26120(.4439
552
606
552
544
414
1272
1242
300

.4439
.0313
.4126

See page 77.

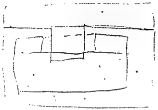


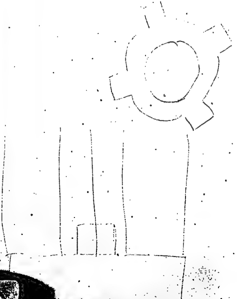
available space for wire.

16 wires $\frac{100}{1000}$ diam.

$\overline{100}^2 \times 16 = 160000$ circular mils

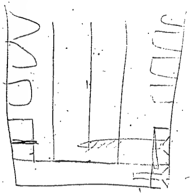
Since the wires actually take up .4 in both directions we have .053 in radial and .013 in circumferential

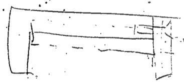


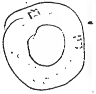


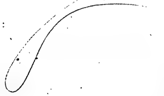
direction for insulation in addition to what has been already allowed.

.40
.30









.25
.02
.025
.4
.475

15 +.02 — .52
.07
.45
.40
.003) .050
.002) 17
8

3.1416
19.51
31416
157080
282744
31416
138) 61.292616 (.444
552
600
552
572
552
206

2) .044
003) .022
.7

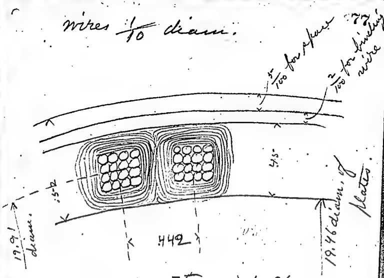
10.25
.495
9.755
19.510

10.25
.22
9.73
19.46

19.46
.75
19.385
3.1416
116310
19385
77540
19385
58155
138) 60.89.99160 (.441
552
567
552
179

19.46
.45
2) 17.91
9.95

wires $\frac{1}{10}$ diam.



7 turns of 3/1000 tracing linen wire fill up space between bundles. 8 turns will fill up allotted space of .45 radially.

Sept. 10,

1880,

Clarke.

2) 19.46
9.73

.05
.0025

3.1416
.0025
157080
62832
.00785400
16
47124
7854
.125664 sq. in. is the actual cross-section of copper in the strands in Armature.

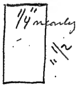

.126 sq. in. of copper.

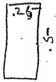
.25).126(.5
.125

Sept 17, 1880 Clarke

If it is made into solid block 1/2" deep the thickness must be

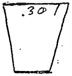
.50).125664(.25
1004
256
250





.25

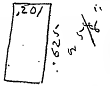
This may be made into a trapezoid



Sept. 17. 1880. Clarke

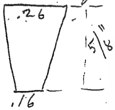
If we allow the depth to be $\frac{5}{8}$" = .625" then the width would be .201

$$.125)\,.125664\,(.201$$
$$\underline{.1250}$$
$$664$$
$$\underline{625}$$



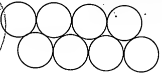
We will allow however .22 for width to allow for brazing and imperfect moulding

or in the trapezoidal form

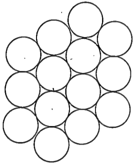


44

$C_{16}H_{20}$

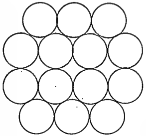


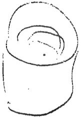
$C_{20}H_{18}$ / n



R. 130.

9:





Sept. 28. 1880.

Experiment on heating of copper rods revolved through the magnetic lines of force.

Temp. of atmosphere at commencement 76.°5 F.

Temp. of Iron Plates of Armature 77°5 F.

Temp. of Fields 81° F.

Time of Commencement 7-27 P.m.

No. revo. per m. 136.

After revolving 10 m. in strong field the temp. still remained 77° F.

Started again at 7-40 p.m.

No. revo. per m. 240

Field strengthened

Temp. of atmosphere remains constant. 76°5 F.

After running 30 m. no perceptible heat.

Third test commenced 8-30 P.M.

No. revo. per m. 300.

30 minutes duration of exp.

Copper bar went from 80° to 87.

4th test

Commenced 9-7 P.M.

No. revo. per m. 300.

Duration 1 h.

Temp. at end 88°F.

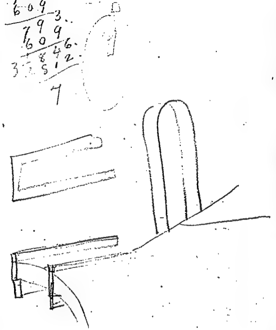
Temp. of air 76°F.

See page 89

203) 787836 (3334) 33000 (9
30006

609
788
609
3
799
6046
33512
7

144



17769
44
71076
71076
781836
78783

144
7
137
137
959
1311
137
17769

Test-continued Sept. 29, 1880 Clarke,

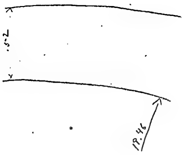
Wednesday

Temp. of air	77° F.
Time	4-30 P.M.
Temp. of copper rods	78° F.
Revolutions per minute	280.
" second test	310.
3rd "	310

Temp. of copper rods after 1 hour 80°F.

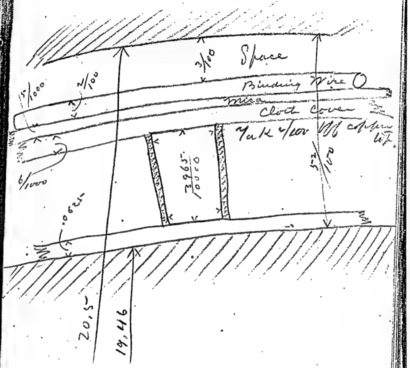
No appreciable rise in temperature was found to have taken place by revolving rods of copper in the magnetic field therefore no injurious local currents and it was decided to adopt rods of large size instead of wires across face of armature.

20.5
1.04
19.46



.03
.025
.006
.3965
.0625

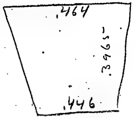
Clarke.



Sept. 30, 1880
Clarke.

19.46
.793
.125
20.378
3.1416
122268
20378
81512
20378
61134
~~61134~~
138.) 64.01935248 (~~.4639~~
.464
552
881
828
539
414
1255
2

19.46
.125
19.585
3.1416
117510
19585
19540
78355
19585
58755
138.) 61.5282360 (~~.4459~~
.446
552
632
552
808
690
1182



$$\begin{array}{r} .464 \\ .446 \\ \hline 2\,)\,.910 \\ \hline .455 \end{array} \qquad \begin{array}{r} .3965 \\ .455 \\ \hline 19825 \\ 19825 \\ 15860 \\ \hline .1804075 \end{array} \text{ sq. in.}$$

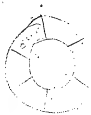
The former made of 16 strands of 1/10 wire had section of .126 sq. in.
So the ratio of resistance will be 126 : 180

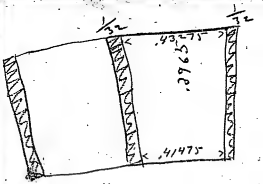
$\frac{126}{180} = \frac{63}{90} = \frac{6}{9} = \frac{2}{3}$

but take out insulation and

2

,02
,01





$\frac{1}{16} = .0625$

$\frac{1}{32} = .03125$

.464 - .03125 = .43275

.446 - .03125 = .41475

2) .8475

.42375
.3965

211875
254250
381375
127125

.168016875

Therefore 126 : 168

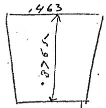
$\frac{126}{168} = \frac{63}{84} = \frac{9}{12} = \frac{3}{4}$

.21638

.3965
.0262
.3765

See next page

.3965
.02
.0625
.3400



Take off .02 from top of
Copper rods 19.46

```
   19.46
    .125
    .753
  ------
  20.338
  3.1416
  ------
  122028
  20338
 81352
 20338
61014
---------
63.8938608  (.463
138) 63.89
     55.2
      869
      828
       413
       414
```

.463 less insulation

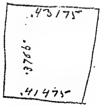
.463 − .03125 = .43175

.0625

$$
\begin{array}{r}
.43175 \\
.41475 \\
\hline
2)\,.84650 \\
\hline
.42325 \\
.3765 \\
\hline
211625 \\
253950 \\
296275 \\
126975 \\
\hline
.159353625
\end{array}
$$

126 : 159

$$\frac{126}{159} = \frac{42}{53} = \frac{7}{9}$$

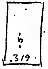


$\frac{1}{16} = .0625$

$\frac{1}{32} = .03125$

$\frac{5}{32} = .15625$

$\frac{7}{8} = .87$



If we assume depth to be half an inch at ends then

.5) .159353625
.31870725 will be the average width

.31870725
.15625
.16246725

163
156
.319

Assume average width to be $\frac{3}{16} = .1875$ we have

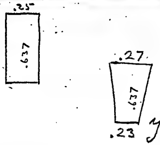
.1875) .159353625 (.85
150004
9353
9375

Assume average width to be $\frac{1}{4} = .25$

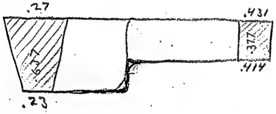
.25) .159353625 (.6374
150
93
75
185
175
.100

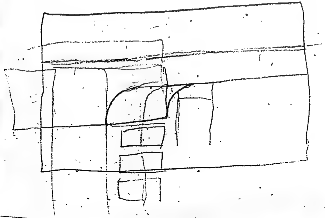
The height will be .6374

Then



This is actual dimension to which block is to be made at ends.



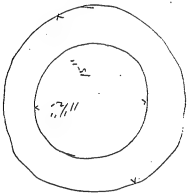


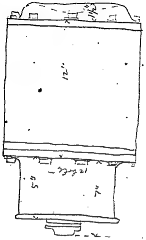
3,1416
19,46
188496
125664
282744
31416
138) 61.135536 (,443
552xx
593
552
415
414

3,1416
20,5
157080
62832
138) 64,40280 (,466
552x7
920
828
922
1132

$\frac{5}{8}$ = .625
.24
2500
1250
.15000

431
.414
2 / .845
1422.5
377
29575
29575
12675
.1592825




1½"
12"
12 inches
5"
7"

120 H.P. dynamo Nov. 18, 1880.

at 600 revolutions gives

132 Volts, see page 23.

If another magnet is added and only 450 revolutions the E.M.F. will be

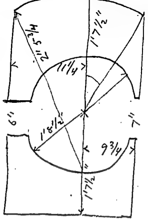
$$132 \times \frac{4}{\cancel{3}} \times \frac{\overset{15}{\cancel{450}}}{\underset{4}{\cancel{600}}} = 132 \text{ Volts}.$$

B

Calculations for Brickeye Engine,

The engine to run at 450 which is 3/4 of 600 revs. for Porter Engines. Masses of iron to be made 1/3 larger.

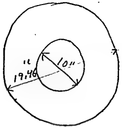
Clarkes, Nov. 19, 1880.



1st
100 H.P.
Constructed for Porter Engine at 600 revs.

When drawn to a scale of 3" to one foot the length of magnets on the face is 7 inches.
The end area is 14.3 sq. in for upper field + 14.9 sq. in for lower field,
Total is 29.2 sqr. inches.
The contents will be
29.2 × 7 = 204.4 cu. inches.

Clarke
Nov. 19
1880.



The diameter of the armature core is 19.46" and hole 10" diam.
The end area will be

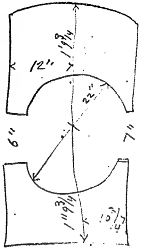
```
  19.46            4)278.7
  19.46               69.7
  11676                3.14
  7784               2788
 17514               697
 1946               209.1
 378.6916       X  218.858 sq. in
  100.                 28
  278.7
```

And contents

```
    1750864
    437716
X  6128.024 cu. in
```

Clarke.

The Dynamo for the Buckeye Engine. Nov. 19. 1880.



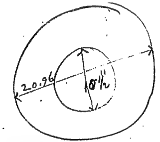
Area of upper field 17.7 sq. in.
+ Area of lower field 18.7 sq. in.
Total 36.4 sq. in. of end area
on a scale of 3" to 1 ft.
If the magnets are 32"
long on the face the contents
will be 36,4 x 8 = 291.2 inches

Clarke, Nov. 19, 1880

Compare this with contents on page 117, 291.2 − 204.4 = 86.8

Then $\frac{868}{2560}$, about 1 to 3, which is the desired proportion —

22
1.04
20.96



The outside diameter of armature core will be 22″ − 1.04 = 20″.96 And suppose it necessary to increase the shaft from 4½ to 5″, which will make the hole 10½″ diam.

The end area will be

$439 - 110 = 4\overline{)329}$

$82,25 \times 3,14$

$= 258$ sq. in. and if

32" long, $258 \times 32 =$

8256 cu. inches

Compare with page 119.

$8256 - 6128 = 2128$

$\frac{2128}{6128} = .163$ which is

the desired proportion.

22.
20.968
1.032
.516

20.50
19.46
1.04
.52

21.03
20.968
2|.062

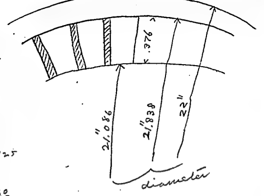
20.5
19.46
1.04

22
21.086
.914

Clarke, Nov. 19, 1880.

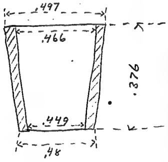
22.162
21.838

21.838
.752
21.086



32)1.00(.03125
96
40
32
80
64
160
160

21.838
3.1416
131028
21838
87352
21838
65514
138)68.6062608(.497
552
1340
1242
986
966



21.086
3.1416
126516
21086
84344
21086
63258
138)66.2437776(.48
552
1104
1104

497
.03125
.46575

.497
.3125
.4645

.48
.03125
.44875
.46575
.91450

.15886
.0227
.1515

.4575) .18150 (397
13725
44250
41175
30750

2/.9145
.4575
.376
27450
32025
13725
.1720200 sq. in. is the end area of the copper rods across the face of armature.

.431
.414
2/.845
.4225
.376
25350
29575
12675
.1588600 sq. in. is the end area of copper rods for Porter Allen Dynamo.

.172
.158
14

.14).158(11
14
18

the ~~resistance~~ area is ~~diminished~~ increased by $\frac{1}{11}$ but the length of rod is increased by $\frac{1}{7}$. ~~and the~~

$\frac{4}{28}$

To make the area increase in same proportion as length or $\frac{1}{7}$ th the end area must be $\frac{8}{7}$ of .15886 sq. in. =

.1815 sq. in. and to have same circumferential dimensions to copper rods, their depth must be

$.1815 \div .4575 = .397$ inches.

which brings the face of the core on armature

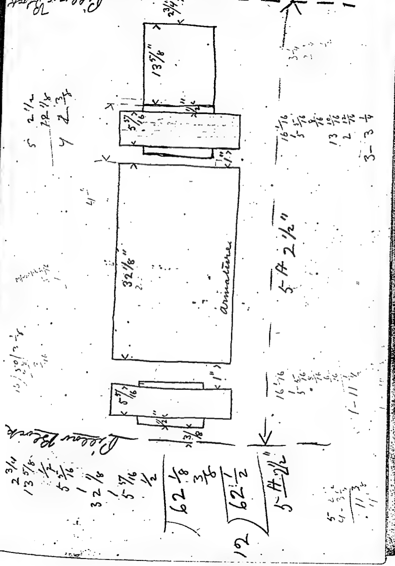
$.397 - .376 = .021$ inches

farther away from face of field than with Porter-Allen Dynamo.

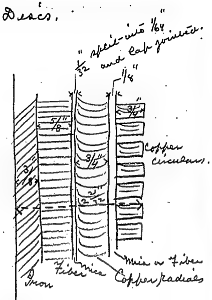
See page 209

for revised dimensions

Weight of sleeve for Buckeye dynamo as per bill of lading 325 lbs.



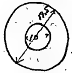
Details of Discs.



Entire width of disc
5 5/16".

$$\begin{array}{r} 3/4 \\ 1/8 \\ 3/4 \\ 1/32 \\ 5/8 \\ 3/8 \\ \hline 2\ 21/32 \\ 2 \\ \hline 5\ 5/16'' \end{array}$$

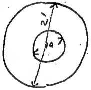
Clarke.



28" long

The weight of the plates of this armature (Porter-Allen Engine at 600 revs.) is 1600 lbs.

The commutator weighs 164 lbs.



32" long

The weight of the plates of the armature for the Buckeye Engine at 450 revs. will be, as calculated from above data, 2300 lbs.

The copper discs weigh approximately 800 lbs. altogether.

Dec. 6, 1880.

Clarke.

Outside this armature there will be 138 copper rods, approximately 34" long and .1815 sq. in. end area (page 131). The contents will be

$$\begin{array}{r} .1815 \\ 34 \\ \hline 7260 \\ 5445 \\ \hline 6.1710 \\ 138 \\ \hline 493680 \\ 185130 \\ 61710 \\ \hline 851.598 \end{array}$$ cu. inches

= 270 lbs. of copper on the face of the armature!

1,6) 1,08 (.675 Volts to 1 degree
96
1,20
1,12
80

1,08) 1,60 (1,48
1,08
520 degrees.
432 to 1 volt
880
864
16 0

.40
1.6
240
40
6 40

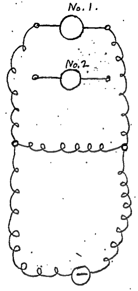
.40) .64 (1.6
1.6

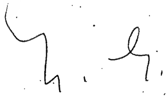
3 40
44 (120

$\frac{3}{2} \div \frac{2}{1}$ $\frac{6}{2}$

$\frac{3}{2}$ 1.

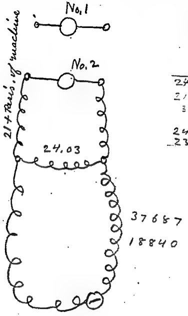
Test for Motors. Dec. 7





37687
21
37708 + x

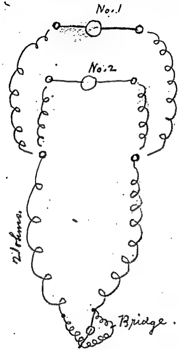
18840
21
18861



19.96
2.02
1.02
.45
.35
.14
.09
24.03
21
3.03

24.03
23.70
.33

U. G.



The resistance was not perceptibly increased by the wires leading to machines. Total resis. outside machines 21 ohms.

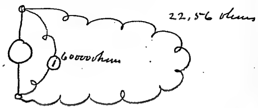
1,48
90
133,20

.675) 90.000 (133.333
67 5
2250
2025
2250
2025

Dec. 8. 1880.

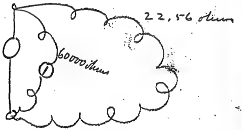
Clarke:

No. 1



N. G.

No. 2



Each machine $\frac{14}{100}$ ohms

No. 1 (965 revolutions.
134° deflection. and .675 ...
-- 5 1°.

No. 2 (965 revolutions.
136° deflection

675) 110 000 (163.
675xx
4250
4050
2000
201

Second observation

No. 10 { 965 revolutions.
138° deflection.

No. 9 { 965 revolutions.
139° deflection

No. 10, as a dynamo,
No. 9, as a motor,
Resistance only that of
the machines and ~~sho~~
Short No. 10 leading wires.

No. 10 (Revolution 965.
Deflection 135°

No. 9 (Revolu 886.
N. G.

No. 10 as motor
No. 9. as dynamo

No 10 Revolutions 938

No 9 Revo. 965
Deflection 139°

N. G.

Field Increased.

No. 10 { Revo. 953
Defl. 147°

No. 9 { Revo. 945
Defl. 150°

22.56 ohms outside.

No. 10 as dynamo
No. 9 as motor.

No. 10 { Revo. 947
Defl. 145° & 146°

No. 9 { Revo. 850

N. G.

No. 9 as dynamo.
No. 10 as motor.

No. 9 (Revo. 881
Defl. 148°–150.

No. 10 (Revo. 932

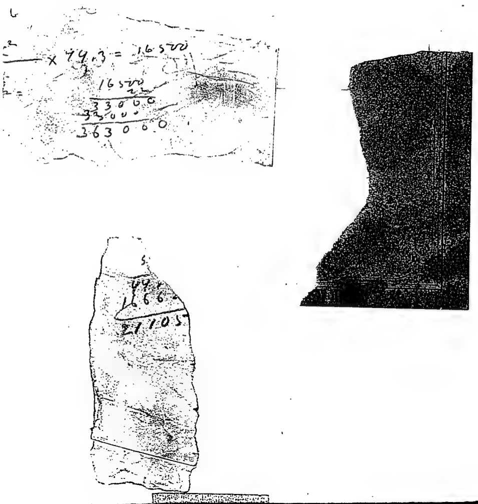
N. G.

[ITEM FOUND IN BOOK]

145 - 146

148 - 150

[ITEM FOUND IN BOOK]



24) .700 (.03
.72 60
80

965 Revolutions Clarke,

Field and E.M.F.

Def. on Magnet.	Def. in Line.
0 Magnet No. 10.	18 — 18
0	28 — 28
1	40 — 40
2	57 — 52
3	63 — 63
3.5	74 — 74
5	89 — 89
8	107 107
10	119 119
11	130 130
16	140 140
22	145 145
32	155 155
68	170 — 170

The deflection is 64° for 40.
Standard Daniel's Cells.

965 revolutions.

Magnet. ~~Magn~~ Magnet No. 5.	Machine	
0	12	12
1	20	20
2	32	31
3	40	40
2	50	50
4	59	60
5	70	70
5.5	85	85
7	105	105
11	122	122
14	131	131
17	138	138
19	142	142
30 - 31	150	150
65	165	168

The deflection is 64° for 40 Standard Daniels Cells.

Clarke

Dec. 13. 1880.

Weight of Copper depositing plates before action of current.

No. 1 — 109.100 gms.

No. 2 — 111.385 gms.

No. 3 — 109.190 gms.

No. 4 — 130.195 gms.

Resistance of leading wires .356 ohms.

Resis. of Magnet No. 5 without leading wires 1.76 - .356 = 1.404

Resis of No. 10 without leading wires 1.865 - .356 = 1.509

Resis of armature in No. 5 without leading wires .507 - .356 = .141

.862
.517
.348
.125
.66

Dec. 14. 1880.

Resistance of armature in machine No. 10 - without leading wires.

.507 - .356 = .141

New test.

Leading wires .348 ohms.

Resis. of depositing cells. Two in series. Plates 1 & 2 - 3 & 4 together .865 - .348 = .517 ohms

---

Total resistance of circuit including depositing cells and machines.

1.21 - .348 = .862

73

Clarke,

Deflection in high resistance galvanometer direct in circuit of machine No. 10. 140°

No. 10. the dynamo —

No. 5. the motor

Speed of motor 895

Speed of dynamo 940

Circuit passed through depositing cells at 3.53 P.M.

Deflection between terminals of dynamo No. 10 140°

Deflection between terminals of motor No. 5, 139°

26.649 : 140 :: 25.927 : -

```
                    25.927
                       140
                 ---------
                 1037080
                 25927
26649 ) 3629780 (137
        26649 x
        -----
         96488
         79947
        ------
        165410
26.649
  .722
25.927

26.6..             26.067
                      140
                 ---------
                 1042680
                 26067
26649 ) 3649380 (137
        26649  xx
        -----
         98448
         79947
        ------
        185010
```


Speed of dynamo
at 3.56 — 940 revs.
Speed of motor
at 4.02
+20 revs.

Circuit broken at ~~4~~ 7.03
Run 10 minutes

Weight of copper depositing plates after test.

No. 1	108.320 gms.
No. 2	112.088 gms.
No. 3	109.899 gms.
No. 4	129.410 gms.

45 . . , –

$x - a$

$y - a$

$x - a$

$y - a$

$v - a - b - c$

M weighs more than $x-a$

$M - x + a$

N weighs less than $y-a$

$y - a - N$

$\frac{M - x + a + y - a - N}{2}$

780
785
703
709
4) 2977
.74425

7.8717188
7.2893660
6.5823528

.000324556
194736

7.8488047
7.2893660
0.5594387

7.03
6.85
.018

703) 18.00 (2

703) 700 00 (

697) 3

No. 2 – Weight after exp. 112.088
" " before exp. 111.385
Deposited in 10 minutes. .703 gm

No. 1 – Weight before exp. 109.100
" " after 108.320
Taken off in 10 minutes. .780 gm

No. 3 – Weight after exp. 109.899
" " before exp. 109.190
Deposited in 10 minutes .709 gm

No. 4 – Weight before exp. 130.195
" " after exp. 129.410
.785 gm

assume the true amount of deposited copper to be the mean we have

$\frac{.703 + .780 + .709 + .785}{4} = .74425$

265.27 : 264.4 :: = 940

264
940
10560
2376
265) 24816 (93
2385
960
795
1650

.000325
600
.07800

.675
140
27000
675
94.500

26.65
862
25.788

94.5

1.9734318
1.5497510
.4236808

1.8450980
1.2953471
0.5497509

26.65 : 25.75 :: 940   265.27
862
228.408

26.65) 24205 (91

24.862
.862
24.

The weber of current deposits

.000325 × 60 × 10 = .1947 gms.

in 10 minutes, The total current is therefore

.1947) .74425 (3.8225

Current = 3.8225 Webers.

Total Equivalent Resis = 94.5 ÷ 3.8225 = 24.772

The E.M.F. is outside dynamo.

Outside dynamo 140 × .675 = 94.5 Volts

94.5	1.9754318
	3.9508636
44.3	1.6464037
	5.5972673
24.772	1.3936790
16003 ft. lbs.	4.2041883

Energy on line outside the dynamo.

Tests Dec. 15. 1880.

Weight of depositing plates before test

No. 1	108.320 gms.
No. 2	112.0~~85~~78* gms.
No. 3	109.899 gms.
No. 4	129.410 gms.

To see if the free H_2SO_4 in the solution dissolves the plates; a plate is immersed in that solution.

Immersed at	12.50 P.M.
Weight before	27.9883 gms.
Taken out at	1.55 P.M.
Weight after	27.9847 gms

An apparent loss of 0.0036 gms.

* The weight was brought to this by exp. page 175.

Plate No. 2
immersed at 2.40 P.M.
Weight before 112.088 gms.

taken out a 5. P.M.
Weight after 112.078 gms.
Lost in 2h.20m 0.010 gms.

The loss for 10 minutes, which was the duration of the test, could not be detected with the balance.

Dec. 16, 1880.

Clarke.

Test of Motor and dynamo.

Weight of depositing plates before the test.

No. 1	108.320 grms.
No. 2	112.178 grm
No. 3	109.899 grms
No. 4	129.410 grms.

These plates were multiple-arcd, 1 + 2 ; 3 + 4 in same cell.

The dynamo was magnet — No. 1. Armature No. with resistance of $\frac{55}{100}$ Ohm.

The motor was magnet — No. Armature No. with resistance of .14 ohm.

Drove a fan blast.

675
243
2025
2700
1350
164025

875
675
4375
6125
5250
590625

262
.675
1310
1834
1572
176.850
- 83.4

The deflection between terminals of magnet No. 1 was
$8\frac{1}{2}^\circ$ — 9° = $8\frac{3}{4}^\circ$ = 5.9 Volts

.675 Volt to 1°.

The motor magnet being in every respect like No. 1 must have had the same E.M.F. at the terminals.

Deflection between terminals of dynamo when doing no work 243°. 164 Volts.

Current turned through depositing cells at 3-36 P.M.
Current turned off at 3-43 P.M.

Duration 7 minutes -

134° 142° 135°

1,832
.951
2,783

.915
1.995
2,910

.675
134 ½
2700
2025
575 337
90.87

The deflection outside the dynamo and depositing cells was 134° — 135° = 134°.5

The deflection between the terminals of dynamo was 142.°

Weight of plates after experiment.

No. 1	106 .488 gms.
No. 2	112 , 993 gms
No. 3	110 . 850 gms
No. 4	127 . 415 gms

No. 1	108, 320
	106, 488
" Increase	1,832 gms.
No. 2	112, 993
	112. 078
" decrease	.915 gms
No. 3	110, 850
	109, 899
" Increase	. 951 gms.
No. 4	129, 410
	127, 415
" decrease	1.995 gms.

33000) 1515000 (4.6
132000
195000

Take the average as the true amount —

$$
\begin{array}{r}
1.832 \\
.915 \\
.951 \\
1.995 \\
\hline
2\,)\,5.693 \\
\hline
2.8465
\end{array}
$$

2.8465 gms in 7 m.

The deposit for seven minutes per weber current is

.000325 × 60 × 7 .13650 gms.

The current was therefore

log. 2.8465	0.4543112
log. .1365	$\bar{1}$.1351327
	1.3191785
20.85	

Current = 20.85 webers.

The total E.M.F. was 16.4 Volts

E.M.F. × C × 44.3 = Energy

log. 20.85	1.3191785
log. 164	2.2148438
	1.6464037
1515000	5.1804260

Energy total 1515000 ft. lbs.
= 4.6 horse power.

Total Volts $\frac{164}{20.85}$ = Resis.
Current

log. 164 2,2148438
log. 20,85 ~~1,3191785~~
7.8644 0,8956653

Resis. = 7.8644

The total volts are 164 but when the current was flowing the volts at the terminals of dynamo were 95.85, showing that there had been a fall of 68.15 on .55 ohm. This fall disagrees with the fall on the total 7.86 ohms and there must have been much polarization.

The test is on the whole unreliable.

164
575
$.555)\,69.00\,(107$
555
400

4.6
52
92
230
239.2
$164)\,239.2\,(1.45$
164
750
656
940

$5.1)\,1.10\,(.216$
102
80
51
290

If 164 Volts are given by the dynamo of $\frac{55}{100}$ ohms. at 950 revs, the motor of $\frac{24}{100}$ ohms will give 82 Volts at 950 but as its speed was 600 the Counter E.M.F. is

$x : 600 :: 82 : 950$

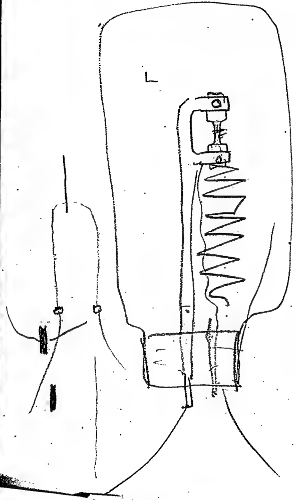
600

$950)\,49200\,(52.$
4750
1700

Counter E.M.F. = 52 Volts, then of the total energy on the line or 4.6 horse-power $\frac{52}{164}$ of 4.6 or 1.45 H.P. is developed by motor and as it takes .35 H.P. to run the ~~dynamo~~ motor at that speed the useful effect is

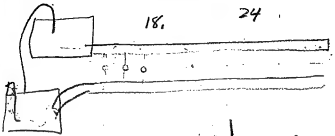
1.1 Horse-power,

so that some 5.1 H.P. are consumed in all and the ratio of useful effect is 21.6%.

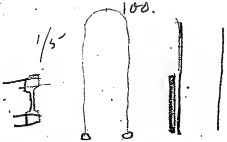

L

9. 6 inch.

12



25.



$\frac{14}{10}$

$$\begin{array}{r} 82 \\ 82 \\ \hline 164 \\ 656 \\ \hline 6724 \\ 44.3 \\ \hline 8172 \\ 26896 \\ 26896 \\ \hline 297667.32 \end{array}$$

$1.4\,)\,297667.32\,(\,211900$

$33000\,)\,212\,(\,6$

Let a $\frac{14}{100}$ armature gives 82 volts at 950 revs.

The resistance with an equal motor will be $\frac{28}{100}$ but if we wish $\frac{8}{10}$ conversion the total resistance must be 1.4 ohms and we have

$$\frac{82^2}{1.4} \times 44.3 = 211.900 \text{ ft. lbs.}$$
$$= 6.1 \text{ H.P.}$$

but ½ H.P. is consumed in friction and local currents leaving 5.6 H.P. but total $6.1 + .5 = 6.6$.

$6.6\,)\,5.6.0\,(\,.8$
$5.2.8$
$3.2.0$

Test - Saturday Dec. 18, 1880,
Clarke,

Weight of Copper plates before test.

No. 1	96,878 gms.
No. 2	99.461 gms.
No. 3	84.177 gms.
No. 4	113.695 gms.
No. 5	117.745 gms.
No. 6	117.818 gms.
No. 7	119.145 gms.
No. 8	120.455 gms.

With cells in
Speed of dynamos 935 revs.
Speed of motor 1500 revs.

3 dynamos $\frac{14}{100}$.
1 motor $\frac{14}{100}$.

Time current was thrown through depositing cells 8-55 a.m.

.675
.145
3275
2700
675
97.775

.675
2.45
3375
2700
1350
165.375

.675
148
5400
2700
675
99900

935
3
2805

2805) 15700 (.56
14025
16750
16830

.675
248
5400
2700
1350
167.400

Time current was thrown out 9-05 a.m.

Duration of test 10 minutes.

Deflection at terminals of motor with cell in 245.0

.675 Volts to 1°. 165.38 Volts

Weight of copper plates after test

No. 1	95.891 gms.
No. 2	98.590 gms.
No. 3	84.943 gms.
No. 4	114.580 gms.
No. 5	118.531 gms.
No. 6	118.862 gms.
No. 7	118.047 gms.
No. 8	119.528 gms

From 3 & 4 - 5 & 6 an upward motion of the fluid noticed.

~~935~~

100 Volts at ~~1000~~ revs,
for dynamo.
Suppose motor at 600 revs.
then counter E.M.F. is 60 volts
dynamo 1 unit of work at unit
speed ~~at one revs~~, strain = 1
~~1000~~
Motor does $\frac{3}{5}$ unit but at $\frac{3}{5}$ speed
and strain is $\frac{3}{5} \times \frac{5}{3} = \frac{15}{15} = 1$

Suppose two dynamos
200 Volts
The two do 1 unit at unit speed
and $\frac{1}{2}$ strain on each belt
motor does $\frac{3}{10}$ work but at
$\frac{3}{5}$ speed and unit strain is
$\frac{3}{10} \times \frac{5}{3} = \frac{1}{2}$.

Suppose three dynamos
300 Volts,
The three do 1 unit at unit speed
and $\frac{1}{3}$ strain on each belt.
Motor does $\frac{1}{5}$ work but at
$\frac{3}{5}$ speed and unit strain.
$\frac{1}{5} \times \frac{5}{3} = \frac{1}{3}$. $\frac{4}{5}$ work Suppose 800 revs 80 volts

with cells out. Speed of dynamos 935 revs
Speed of motor 1570 revs

Deflection at terminals of
motor with cells out, 248°
or 167.4 Volts

Change of weight in plates.

No. 1	lost		.987 gms.
No. 2		1.858	.871 gms.
No. 7			1.098 gms.
No. 8		2.025	.927 gms.
No. 3	gained		.766 gms.
No. 4		1.651	.885 gms.
No. 5			.786 gms.
No. 6		1.830	1.044 gms.

1.858
2.025 ——— 3.883
1.651
1.830 ——— 3.481
2) 7.364 .402

Average 3.682 gms. in ten
minutes.

16500
49500

.167

.179

145210
49500
194710

110330.0(.56
97355.0
1297600

unit work

$\frac{1}{3}$ shown in each test

$\frac{4}{15}$ work at $\frac{4}{5}$ speed

$\frac{4}{15} \times \frac{5}{4} = \frac{1}{3}$

138550
136330
2220
8880
8.745

136330
8880
145210) 136330.00(9.4.64.4
130689
564100

18.911

The deposit per weber of current for 10 minutes is

.0003 2958 × 60 × 10 = .1947

log. 3.682 — 0.5660838
log. — $\bar{1}$.2893660
18.911 — 1.2767178

Current = 18.911 webers.

Volts. log. 165.38 — 2.2184830
log. 18.911 — 1.2767178
log. 44.3 — 1.6464037
73855.0 — 5.1416045

Energy developed in motor
13855.01 ft. lbs.

Volts log. 165.38 — 2.2184830
log. 18.911 — 1.2767178
8.745 — 0.9417652

Resistance in motor
8.745 ohms – but .14 only is true resistance the rest

n dynamos , 1 motor

E volts , e volts

nE volts , $\frac{e}{E}$ Speed

$\frac{1}{n}$ = strain on dynamo belt

$\frac{e}{nE}$ = work by motor

but work is done at $\frac{e}{E}$ speed

Strain on motor = $\frac{\text{Work by motor}}{\text{Speed}}$

$$'' = \frac{\frac{e}{nE}}{\frac{e}{E}} = \frac{1}{n}$$

$\frac{935}{2805}$

1500

being due to counter E.M.F.

x : 138550 ft. lb. :: 8.605 : 8.745

log 138550	5.1416045
log 8.605	0.9347509
	6.0763554
log 8.745	0.9417652
136330	5.1345902

Consumed in work by motor 136330 ft. lbs.

~~This is at a speed of 1500 revs. and the drag is therefore in the ratio of $\frac{136330}{1500}$, Each dynamo has this same drag per revolution and there being 3 at 935 revs. we have total work in dynamo drag~~

~~$\frac{136330}{1500} \times 3 \times 935 =$~~ The field in dynamos were not in same conditions as in motor.

2805) 15000 (5
14025
15

165
195

33000) 304440 (9,2
297
70

138550
8813
175363

254940
136330
118610

16500
150
825000
16500
2475000 (26000
95) 2475
190
570
570

198520) 536910 (27
397040
1398700
1389640

304440) 1103300 (362
913320
1899800
1826640
73160

log 136330 — 5.1345902
935 — 2.9708116
3 — 0.4771213
8.5825231
1500 — 3.1760913
254940 — 5.4064318

Drag on dynamos
254940 ft. lbs.
By previous expts the dynamo at 935 revs takes in friction 1/2 H.P.
∴ 254940 + 49500
= 304440 ft. lbs. = 9.2 H.P.
total energy expended,
The motor at same ratio will take at 1500 revs
$\frac{150}{95}$ of 16500 = 26000
The useful effect of motor will be ~~136330~~ − 26000
= 110330 ft. lbs.
or ~~36~~% = 3 1/3 H.P. useful.
57%

314
30
94.20
2000
1884000
27
131880
37680 00
72) 5086800 (70000
504
2

162.74
965
81370
97644
146966
1570446.50 (104.7 Volts at 965 revs.

.675) 104.7 (155° = deflection.

94.5
1500
47250
945
965) 141750 (152

70.25
1500
5012500
1025
965) 15037500 (155

165.3

Deflection at terminals of dynamos 239°,

At 965 revs. a 14/100 machine gives 94.5 Volts and at 1500 we have

94.5
1500
472500
945
965) 1417500 (146.9
965
4525
3860
6650
5790
8600

at 1500 = 146.9 Volts

This then was the counter E.M.F. at that speed.

165.38
2.64
162.74 Counter E.M.F.

155.35
1500
7767500
935) 23302500 (24800
1870
4602
3860
7425

21.838
3.1416
131028
21838
87352
21838
65514
138) 68.606 2605 (.497
552
1340
1242
986
966
202

27
23
50

21.044
3.1416
126264
21044
84176
21044
63132
138) 66.11 1 8304 (.479
552
1091
966
1251
1242

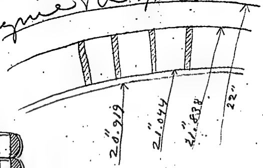
466
445
2)914
457
397
3199
4113
1371
25) 18.142 (.725
175
64
50
142

32) 1.00000 (.03125
96
40
32
80
64
160

497
03125
46575

479
03125
44775

Buckeye Dec 31, 1880.
Engine & Dynamo



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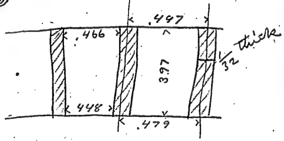
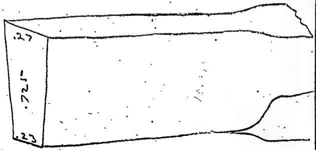
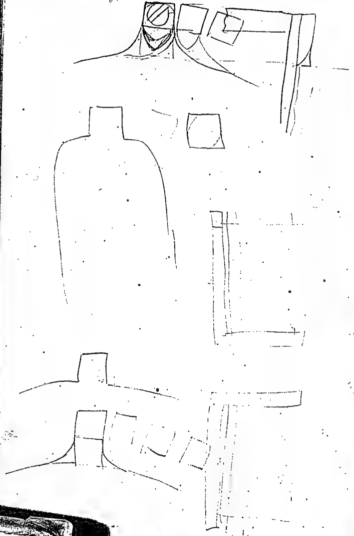


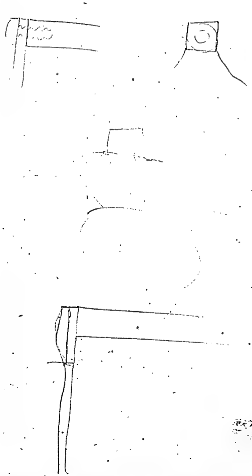


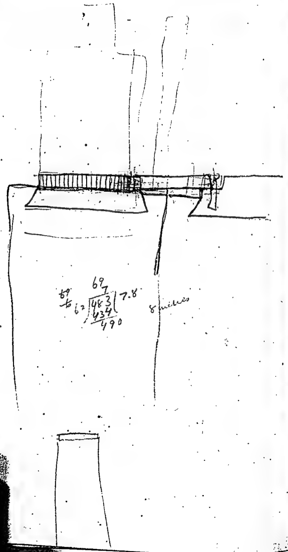
$\frac{1}{16} = .0625$

$\frac{1}{64} = .015625$



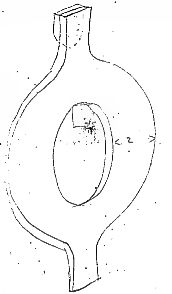
4
1
5
65
45
20
64) 340 (5 1/2
320
200





69
7
62) 483 (7.8
434
490

8 inches



For dynamo $mS + nE^2 + EC$

but EC is the total energy of induction developed in the circuit and if D is the armature drag we have

$$DS = EC$$

For motor field in same condition

$$eC - ms - ne^2$$

but drag is same as in dynamo

$$Ds = eC$$

For ratio of work by motor to total work

$$r = \frac{eC - m's - ne^2}{EC + mS + nE^2} \text{ or}$$

$$r = \frac{Ds - m's - ne^2}{DS + mS + nE^2}$$

In differentiating mS and nE^2 are constant also S

Now e varies as S $\quad e = bS$

therefore

$$\frac{E'(E - E')}{R}$$

~~$W = E^2 - EE'$~~

~~$dW = 2EdE -$~~

$W = EE' - E'^2$

$dW = EdE' - 2E'dE'$

$\frac{dW}{dE'} = E - 2E' = 0$

$E' = \frac{E}{2}$

$$r = \frac{Ds - ms - nb^2s}{DS + mS + nE^2}$$

mS, nE^2, S, m, and nb^2 are constants under differentiating.

$$dr = \frac{SdD + Dds - mds - nb^2ds}{SdD}$$

~~$dr = 1$~~

$dr\, SdD = SdD + D\,ds - m\,ds - nb^2ds$

$SdD(dr - 1) = ds\,(D - m - nb^2)$

25 lamps of 125 ohms.

$\frac{14}{100}$ ohms machine

deflection at terminal of machine with one light of 16 candles = 168°

Total deflection

```
    125.14
       168
   100112
   75084
  12514
125)21023.52(168.19
    125
    852
    750
    1023
    1000
      235
      125
     1102
     1105
```

Total 168°,19

With 25 lamps in the external resistance is 5 ohms and deflection at terminals of machine

```
       168°,19
              5
5,14)840.95(163°.61
     514
     3269
     3084
      1855
      1542
       3130
       3084
        460
```

Suppose 8 lamps of 125 ohms total external resistance is 15.625 ohms and with 168° deflection at terminals of machine the total E. M. F. is

```
       15.765
          168
       126120
       94590
      15765
15.625)2648.520(169.5 volts
       15625
       108602
        93750
        148520
        140625
          78960
          78225
```

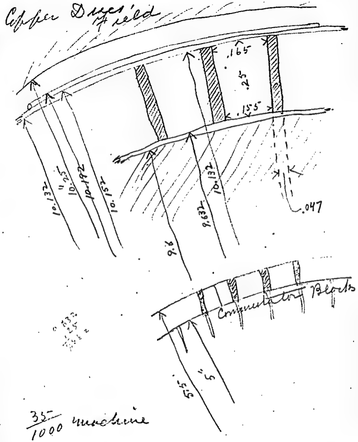
Now if the total E.M.F. be 169°.5 Volts and 24 lights be thrown in the external circuit, is 5.208 ohms. and deflection at terminals is

```
      169°.5
      5.208
     -------
     13560
    3390
   8475
5.348) 882756 (165°.1
       5348
       34795
       32088
        27076
        26740
         3360
```

```
 168°
 165°.1
 ------
   2°.9
```

```
  .675
   2.9
  ----
  6075
 1350
 -----
 19575
```

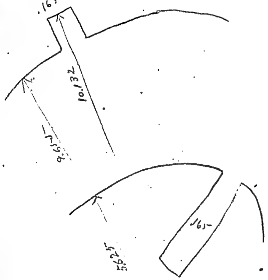
19

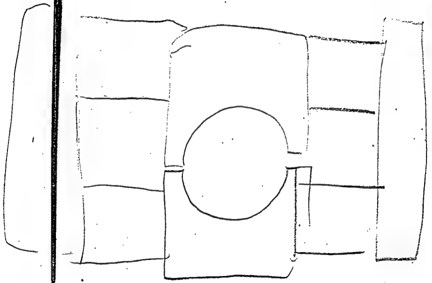


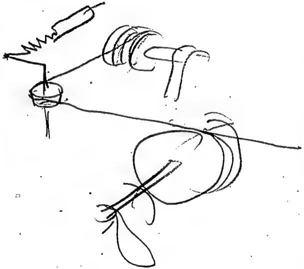
35/1000 machine

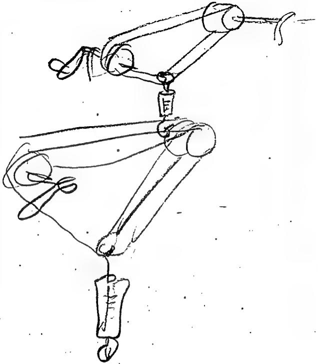
Clarke,

Copper Discs. Jan. 19, 1880.









$x - a$

$y - a$

$M > x - a$

$N < y - a$

$$\frac{M - x \cancel{+N} + y - N}{2}$$

$$\frac{M - x \cancel{+a} + y \cancel{-a} - N}{2}$$

130
30
000
390
900

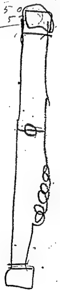
130
130
3900
130
16900
1.73

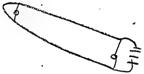
15
.08
1.28

67600
67600
1.28) 748.678

7086
1024
627
512
1150
115

33000) 584200 (17.7
334
254
231
239



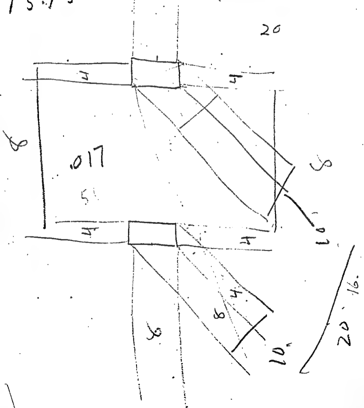


130
130
3900
130
16900
67600
67600
67600
743,600

25
63
75
150
15.75

8

17
8
25
7
195

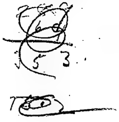


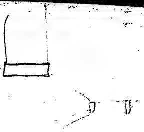
Face 8
Sides 17
Average $15.75
17.7

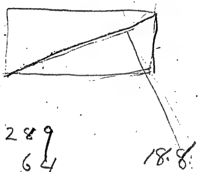
30
30
900

$$R = \frac{10.64\ Z}{m}$$

900)10.64(.012
900
1640 .012)1.140
12





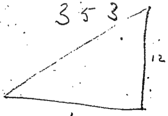


17
8

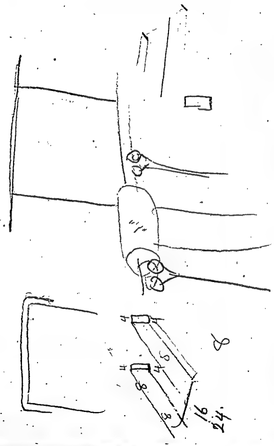
289
64
353

289
444

64
32



5.7
17.7



Menlo Park Notebook #117 [N-80-07-10], Cat. 968

This notebook covers the period July 1880-January 1881 and contains 283 numbered pages. It is the second of two journals kept by Charles P. Mott, which record daily activities at the Menlo Park laboratory (see also Menlo Park Notebook #53). There are also six pocket notebooks that were probably used to record these daily activities prior to their being entered, sometimes in expanded form, into the larger notebooks (see Pocket Notebooks). The first journal begins approximately one month before the earliest extant pocket notebook. However, the last pocket notebook contains entries for the period January-March 1881, which are not found in the journals. Some of the entries in the journals are cross-referenced to the experimental notebooks. Together, these books provide a narrative record of the last active year of the Menlo Park laboratory up to the time that Edison moved to New York City.

Blank pages not filmed: 1.

Lamp posts. A number of large turned lamp posts after a design by Mr. Kruesi were received this morning. they are designed for the large fancy globes and will be in at conspicuous points.

Palmetto Lamp. was examined on the pump and tested. Resistance cold 483 ohms hot 300 ohms and at 17 candles gave 9.6 per horse power.

Bamboo. cut from top or outside edge of fans. Resistance cold 188 ohms at 16°c. 114 ohms and gave 8.6 per horse power. Book 104 page 26 &c.

Black Hills. Miner here with rich ore and tailings from the Black hills and reports plenty of the latter to be had there almost for the taking of it out of the way

Pump. Holzer called my attention to a pump he had recently made and which had been tried by Geo. Hill. it differs from

4 the other only in having three contractions in the drop tube instead of one as in the other. he claims that the additional contractions act as valves and prevent any air from returning after it has been started down the tube and carried below the second contraction. Hill claims the pump to work very quickly and fast.

Lunch [illegible] Logan today cut end off of armature shaft preparatory to putting on [illegible] thrust bearings for screw gear motor.

Work general on past week. Mr Batchelor, Force and [illegible] principally on clamp machine the former a little on captive balloon. Smith and one or two assistants on Magnetic brake. Logan and Martin on gear of electric locomotive. Several at Lamp Factory. Gang on R.R. and on conductors. Dean finishing up wood miller. Glass blowers on 5½ hundred pumps. Bradley Flammer & Van Cleve on experimental carbons. Upton & Clarke still absent.

Monday July 12. 5

Bamboo: A bamboo lamp tested Saturday was put at 44 candles this morning got very blue at clamp and lasted 1 hour 15 minutes.

Interference evidence in Interference case with Maxim, on use of platinum in electric light, is being taken to day.

Armature. Another armature in the first machine was singularly burned out to day. One trip on Rail Road had been made and no apparent diminution of current at time of shutting off, near Depot. but when connection was made for another trip no current was on and a short blow on the whistle indicated trouble inside. On examination the wires were found unburnt. but the solder at commutator had melted. and thus thrown out the machine

Lamp Factory. All wires for Power &c.
were run to and connected at
Lamp Factory. Telephonic communi-
cation opened between there and
Mr. Francis office. A couple two
men putting up the pipes for the
Root Blower which was taken apart
and cleaned and adjusted by
[illegible]. Moffett cutting out
the bottom of pump frames to admit
the back part of gauge slide and
has one hundred of the pumps mounted
and ready for rubber tube connections.

Double Lamp & Holder } Mott today made Patent
Office drawings of the
double lamps and holders for the
same from sketches made by Mr.
Edison same general principle of lamp
&c mentioned under date of June 18
and as originally sketched in Book No 63
page 167 &c. The P.O. drawings represent the
globe lamp instead of tubes which were found impractical.

Circuit changer. Francis is fixing up an
arrangement for rapidly changing
the current for the purpose of experim-
enting on lamps ~~with~~ reversing the
current which heats them. He provided
a conducting ferrule sawed from
one side about 3/4 of an inch from the
end, in to about the center, near the
opposite end sawed in the same
way but from the opposite side. these
two cuts are then connected by another
cut ~~connecting the two first cuts~~ in
such manner that the ferrule is divided
in two parts, insulated from each other
but ~~overlaping~~ interlacing in such
manner that a brush contacting with
it, connects first on one side and then
on opposite side as the ferrule is revolved
on a stick to which it is secured, and which
is rapidly revolved by an electro motor. using
four brushes on the ferrule. two on the central
split part and one on each solid end,
reversing the current with rapidity dependent on
revolving speed of ferrule 

Captive baloon. The other evening Mr. E. had the current of small dynamo turned onto the motor with which the baloon experiments were being made and burned out the commutator. Mr. Batchelor has to day finished a new motor more powerful than the other and secured to it the same wheel previously used. The dynamo current was again applied and the wheel revolved with fearful rapidity. All standing well back expecting to see the wheel fly to pieces by centrifugal force. The motor was placed on the scales, and indicated a lifting power of 4 pounds.

Edison Mr. Upton and others interested in Mason interference.

Lamp made with fine platina wires secured on the leading wires in imitation of saw teeth made & am informed for observations on the deposit of carbon.

Current Carbon. Tried on a lamp this morning it made the lamp rather reddy and did not prolong its life at least it gone as soon if not sooner than when permanent current has been used.

Captive Baloon. Mr. Batchelor secured on the motor of captive baloon in place of the air wheel, four palm leaf fans. and lifted six ounces. Afterwards removed two and lifted fourteen ounces and by removing the two feather rings the center by metallic arms was able to lift 17 ounces. The fans may be set at such angle as will give a fine motion to the air and make a neat and desirable apparatus to combine with electric light system for ventilation or keeping air in room in agitation.

July 13 (continued)

B.R. Lamp tested by Mr Upton and found to be badly grounded about two ohms as near as I can guess from figures in Book No. 103, page 113,

Wood Miller. Dean put several blocks in new wood miller and for the first time found it to work very nicely the knives only requiring to sharpen and true edge.

Coal dust. Masons commenced laying the walls for the furnace for burning coal dust.

Carbons. Messrs Edison and Batchelor made descriptive list of solutions and their manner of being applied to carbons, or material before carbonization, Book No. 105 page 21 &c.

Bamboo Lamp. Carbon split separating it into four distinct fibres. Never before observed in a carbon in breaking.

Returned. Mr Upton from his trip East with family.

Wednesday July 14.

Pumps. Four hundred and eighty pumps using up all suitable tubing in stock, were finished up this morning, having been the principle work of the glass blowers since May 17 or very nearly three months. An average of about five pumps per day for two expert and part of the time two assistant glass workers.

Calorimeter & Galvanometer Tests have been to day by Mr Upton on lamps with fibres saturated with different solutions. One best lamp run on running current lasted nine minutes. Another run on reversing current burned 1 h. 41 m. above Book No. 103, page 121 &c. & 103 p 141.

Visitors. Mr Babcock of Babcock & Wilcox with a couple friends, probably to observe the progress of the dust burning furnace the design of which is by that firm. Mr Edison suggested to him to experiment on light weight high pressure boilers. probably for aerial navigation experiments.

Carbonization. Some vase carbons having the sides painted with solution of double chloride Ammonia and Platinum. were carbonized by Mr. Batchelor and Van Cleve. Lamps Nos. 260 to 270 with inclosed are of carbons thus treated. Results. No. 165, gave 23 Ω & No 67, gave 155 Ω.

Bamboo Bradley is getting out some Bamboo fibres with ends 1/16 by .020 with measuring each same as regular 1/2 by .012. finds them very difficult to get out from the former and tools than used for the regular.

Silver Pocket. A Photograph of the shafts &c of the Silver Pocket Mine showing the levels and distance the pumps for removing the water have to be worked was received. and Messrs Edison Horning and Batchelor are discussing the means and advantages of applying dynamo motors for the working of pumps for deep mining.

Ore Separation. Dr. Moses had Andrus make a shoot or small sluice box about one foot wide and three or three and one half long with bottom covered with glass. for experiments on the separation of ores suggested by Mr. Edison. he then procured two pieces of copper tubing perforated with a line of fine holes. and by forcing water through them ~~and~~ permitting the water to flow down over the glass which is set at an incline he has shown some very nice work in washing the Sulphuric ores

R.R. grade. At noon to day some of the boys were trying the flat car on the hill to gulley and made a trip or two successfully but finally when starting from the top. the brake chain broke and the boys unloaded themselves except Hickman who was thrown when the car jumped the track and was pretty well

burned and the brake of car broken and bent up. otherwise the car was not injured.

Loops. Mr. Batchelor is to day painting the ends of some Bamboo loops before carbonization, to be sure through the furnace but once.

Bamboo Former. Mr. Batchelor sketched shape and dimensions of Bamboo loops and figured the shrinkage of carbonization to be 20 %. Book No. 102,621. Andrews is making the formers in which to carbonize the Bamboo allowing for the 20 % Shrinkage

Conductors. The gang that have been at work on Laying the conductors to the Street Lamps since May 1. got them all down to day. but there is still a large amount of it to tar, cover and fill trenches. This job has taken Two & one half months with an average I should judge of six men, in the work

Gas Works. Gas apparatus for works at Lamp Factory was received from Rahway and put in position. at work progressing rapidly on gas and air fixtures for the glass blowers.

Visitors Gen. Palmer with Mr. Painter also the European Telephone man Dr

Mr. Clarke also returned from his vacation trip having been absent since July 2?

Pay day. Last week's Pay day was for some reason continued on until to day

Lamp Factory. Douglass Pump for well a cistern received and delivered there this morning.

Track. The rails of Electric Rail Road were raised and tarred felt put under one rail and tar under the other for insulation. Men are working at it from depot out.

Conductors to Street Lamps were to-day tested by Mr. Upton. Book No 103, pages 145 to 155. 18 wire circuit, wire to wire 55 ohms. Ground 25 & 43 ohms. 25 wire circuit South wire to wire 1.4 ground 4.2 and 8.2. Six wire circuit wire to wire 61.8. ground 25.6 & 50.5 Edison line wire to wire 1.6 ohms and ground 5.8 and 9.4 ohms. It will be seen that some of the circuits are very badly insulated and all more or less defective. Men have been set at work uncovering parts of the trench of 25 wire circuit and removing

the dirt from around the lamp posts. After the boxes had been raised out of the ground at low wet points it was retested but with same results. It seems a little strange that unexperienced men should be permitted to put down nearly five miles of wire and cover it without being required to test a single circuit or wire until the entire work is finished and it will now require considerable extra labor and delay in putting the circuits in working order.

Wood Miller. Dean got wood milling machine cutting the loops of .010 diameter beautifully and calipering evenly all the way around and was preparing the saw for cutting them off when Mr. Edison, admitting the perfection of the machine, directed him to clean it up, take it apart and put away, as at present the fibres were an improvement on the wood and the machine would not be required

unless at some future time. this Machine was commenced about June 11. and is so complete in all its 226 parts or pieces and so perfect in working that it ~~seems a pity to have it~~ should deserve a place amongst the ~~go into~~ the archives, rather than being in all probability carried off piece by piece.

[illegible] machine [illegible] finally completed [illegible] differs materially from [illegible] [illegible]

Carbonization Mr. Batchelor treated some carbons by dipping the ends in hot syrup and some in an alcoholic solution of syrup. and had them recarbonized. the syrup collected in globules but was carefully removed by Mr. Edison.

Visitors A large party of french gentlemen also one of the London Telephone men and a man with model for rail road. sent by Gen Butler from Lowell Mass.

Absentees. Mr. Clarke gone to Philadelphia to note progress and hurry work on the Porter Allen Engine

Armature. Force finished an armature. with same amount and quantity of wire but wound and connected in such way as to give .55 ohms. resistance. instead of about one seventh of an ohm as ~~[illegible]~~ the others have

Absentees. Crosby and Lawson were heard from to day, in the western mining regions as representing themselves from T. A. Edisons Laboratory, perfectly familiar with his mining processes and applying ~~for~~ to owners for mines or tailings to work.

Bamboo. Carbon of Bamboo with slight notch cut in one side set burning at about forty candles. in about five minutes the clamp on one side melted down. forming a globule on the end of the wire. and destroying the carbon. Lamp Number 1277. Book No. 57 page 159.

Blow Pipe on ores } Dr. Haid experimenting on metals with blow pipe assumed to day that in using sheet iron coated with carbon from lamp flame, and metals such as zinc, tin, lead &c. in connection with soda, placed thereon and subjected to flame by blow pipe, each metal had its own peculiar characteristic of the colors or shades deposited on the carbon in the immediate surrounding of the metal. All of which he claims as entirely new and original.

"Street Lamps" conductors } Men at work all day on the 25 wire circuit removing the soil from around the posts and uncovering the boxes in many places, but late this after noon when tested by Mr Upton no improvement or change was found to have been effected. And as Mr Howell to whom this work had been entrusted seems ready and more than willing to take advice, and listen to suggestions

that if taken in time might have saved him the annoyance of having made a partial failure, and would surely have saved Mr. Edison the extra expense of redoing this work.

Work general in Mach. works. Men at work at Gas and Air works and fixtures at Lamp Factory. Men finished the preliminary laying of the conductors to Street Lamps. Dean finished wood miller, took it apart and put away. Gear of electric locomotive about finished. Mr. Batchelor again interesting himself in experimental carbonization. Messrs Edison and Upton experimenting with and testing lamps.

Gas House. Frame raised for gas house at Lamp Factory.

Carbons. Mr. Batchelor pasting platina foil on the ends of carbons and recarbonizing them the object being to make better contact with the clamps and toughen the ends.

Slotted plates. Yesterday Flammer cut some plates with slots about 1/32 of an inch wide in which to Recarbonize after the carbons have been treated with a solution or the ends covered with Platina foil.

Captive Baloon. Martin Force prepared one of the sewing machines motors to work two sheet iron fans. 2 ft 9 in long and tapered from 6 1/2 inches wide on inside to 9 inches on the outside and tried it today. Results not very encouraging. The original sketch of the electric balloon will be found on page 55 of Book No. 108 and dated July 9.

Mining. Mr. Edison sketched several devices to be tried in experimenting on the separation of ores by air blast. Book No 108. page 29 &c. and instructed Martin Force to make a box about 2 ft deep, 2 in by 12. and arranged with a perforated 1/2 in pipe on one side of box to give air blast against the sands &c dropping through a small slot in hopper.

Bamboo Pure. Some Pure Bamboo (genuine) was obtained and given to Bradley from which to cut some loops. (The Bamboo previously used was Calcutta Bamboo) The genuine is very fine grained and works nicer than the other.

Tar Insulation. The leakage in the Street Lamp Conductors was thought to have been caused to some extent by the conductivity of the tar used in the boxes. To test the tar, two copper plates were immersed in a bucket full and tested by Mr. Upton proved to be a good non conductor. Book No 103 page 183. The copper tacks which had been used to secure the wires in the boxes were taken out but made only 5 ohms difference.

Magnetic Separator. Woods. commenced work on the frame for practically working the magnetic separator and on a full & complete working mill to fully test its practicability and commercial value, for Mining purposes.

Bast Regular. A regular bast fibre lamp was tested by Mr. Upton. Measuring its resistance as it was brought up gradually (to study the rules governing the fall in the resistance). At 7.8 candles. 102.65 ohms. 8.6 candles 103.25 ohms. 9.8 cand. 102.2 ohms. 14 cand. 100.6 ohms. 17.5 candles 99.15 ohms. 44 candles 89.40 ohms. Book No. 103 page 185 &c.

Rail Insulation. Mr. Edison sketched several forms and ideas for insulating the rails for an electric Rail Road. which he gave Mr. Clarke with request to draw them out more fully and to add any ideas or suggestions of his own, for trial in the present track, in connection with the insulation already tried and mentioned under date July 16, to determine the best and most economical method of rail insulation

Visitors. A gentleman connected with the Metropolitan [illegible] R.R. of London also Clarke of the N.Y. Herald

Track insulation. (Insert note Rail Insu. Approx. page) - Mr. Upton tested the track today the ground and sleepers being very wet from heavy rains. track apart near top of hill. Between rails 5 ohms. disconnected at end of insulated rails about one hundred feet from station. [illegible] rail ground .12 ohms. tarred paper under rails and spike heads .24 ohms. Book .37 page 1.7 &c.

Clamp Machine. Mr Batchelor made sketches and wrote descriptions of a number of improvements on the model to be added to the machine to be made for practical use. Book No. 102, page 23 &c.

Lamp Factory. Six men are at work today caulking the floor under the mercury pumps in the Lamp Factory, the iron reservoir pipes having been taken up to give them a chance to work under the double row of pumps now up.

Douglass pump arranged and put in the well.

Small Engine at Lamp Factory together with the boiler were taken out and apart and prepared ready for shipping.

Fibre Formers. Dean is making a pair of formers for cutting out fibre each one is designed only to cut one side or edge and intended to be secured to the bench and drawn and held together by a treadle leaving the operator both hands to adjust and use in cutting the fibre - or one operator can by use of the one former cut the straight edge and pass to second operator to cut the concaved side.

Water. The engine was run during noon time to day to pump the water out of the Pond, and men have been set at work shoveling and drawing out the muck &c. to deepen and give the Pond greater capacity for holding water.

Visitors Goddard & Lowrey with friends. J W Miller

Gas Carbonizing furnace resumed.

Ore Washing. Mr. Edison made several sketches of different apparatuses to be made by Martin Force for experimenting on washing ~~ore &c~~ and other separation of ores. One, of five consecutive planes each a little lower than the preceding one and each plane provided with a rake worked by an eccentric on a counter shaft running parallel with the sluice, and moved back and forward across the plane, down each rake is conducted a flexible rubber hose to convey the water which may be discharged as found, by experiment, to do the most effective work. Another is of a shallow five inch deep tub secured on a frame work in such manner that it may be easily rotated and is given a quick back and forward rotary motion by an eccentric or crank motion. Water is conveyed into the tub by hose or pipe, but could not tell from the sketch what style of discharge was intended to be used. Two others so indefinite in the details that could not describe them until apparatus made.

Average test } From the lamps so far tested
on Lamps } at 44 candles, the average life
was taken and found to be, for Bast
6 minutes. Calcutta Bamboo. 17 minutes
and paper about three minutes. The
Bamboo carbons were in many cases
imperfect which has probably reduced
the average for them. but which will be
undoubtedly raised when proper precaution
and care is used in selecting only
perfectly cut and prepared carbons.
Book No. 112, page 78c. A paper carbon
lamp tested to day at 44 candles lasted
8 minutes and at 13 candles gave 11.5
per horse power. Book No. 103, page 29 &c.

Track insulation. Mr. Edison directed that
one hundred feet of track should be
insulated by use of hard rubber blocks
1/8 of an inch thick and four inches
square, both outside edges to be turned
up and over top of rail flange so the
spike head would also rest on the
rubber according to the estimated price

of rubber suitable for the purpose the cost
per mile of this manner of insulation
would be about $176. Mr. Clarke also
sketched and described a method for
insulating rails in Book No. 115, page
18c. in which he uses a hard wood
block fitted to the flange of the rail and
extending from the body of the rail to
a little beyond the flange. and over
this places an angular iron washer
bent to fit the wood lap down over
the under and having two strips cut
and bent out to enclose the spike
and prevent the washer or wood from
working out of position.
He is also at present carefully studying
up, and searching for data as to the
power required and best mechanical
means of construction of an electric loco-
motive for practical heavy freighting
use:
Absent Mr. Batchelor went to New York. 11 20
to see his family off for Europe.

July 21.

Gear. New man commenced putting the arm and clutch gear on the electric locomotive.

Reverse current. The motor and cylinder for rapidly reversing the current was adjusted, magnets rewound and fixed up by John Ott. And a couple lamps run on the reversing current burned quite steadily the flicker was only perceptible in the lamp but was scarcely noticeable in the light

Bamboo at 44 candles lasted 4 minutes and a Bast 20 minutes the Bamboo however was a bad carbon. Book No 3, page 257.

Magneto calls. A man brought a new design of switch board by Bergmann. Mr E. liked the design but feared the contact. He also brought a Bergmann and Blake magneto calls. The former worked through 1000 ohms resistance and the latter through 1200 ohms. Also a Edison telephone arranged with a device by

July 21

Johnson for the battery call. which appeared very simple and effective but it was not tried

Carbon tester. Mr. Edison suggests that by bending the fibres after they are cut out any unevenness or excess of pith may be detected by the irregularity of the circle and may be thrown out. He also sketched an idea of a bell to be attached to a large Geisler pump, in which one hundred of, or thirty, carbons may be placed and after sufficiently high vacuum may be heated to a red, and irregularities or spots be thus detected. And only the perfect and desirable carbons be placed in the lamps.

Japanese Bamboo. Two lamps connected on the pumps

Power to move cars &c. Scales were used ~~on the car~~ this morning to make dynamometer test of power required to move the motor and cars of the electric road. In starting the open car the scale drew 16 pounds. To start open and box car 64 pounds. To keep both running after in motion with current on motor forty lbs. To start engine 86 pounds and to keep up motion 64 pounds.

Japanese Bamboo; two lamps of Japanese Bamboo were completed and tested this morning. Both carbons were slightly defective and at forty four candles direct current ~~and~~ lasted 15 and one 20 m. Book 103. page 263 &c.

Carbonization. Some loops of white Holly, Tuttle wood, Tulip, and Amaranth were cut by Bradley on fibre former, one Amaranth carbon was got out and in the lamp in perfect shape. The wood was very brittle and was soaked in alcohol before bending Book No 57 page. 175.

Gear Men are at work putting on the arm and clutch or reaping gear on the electric locomotive.

Track insulation. During the heaviest of the rain and after it had been raining two or three hours Mr. Upton tested the track and found only 4.8 ohms between the rails. (The track was in as unfavorable a condition as in practice it could be by atmospheric influences.)

Water. The heavy rains have stopped all work on cleaning out the pond for the pump, as well as all outside work today.

Fibre former. In addition to the box and blade device for holding the former together (See July 20) Dean has added a frame, worked on a hinge, ~~which~~ ~~made~~ composed of three bars the center or connecting rod of which may be covered with soft rubber and close down on the fibre to press it evenly in the slot, without the danger of bruising or injuring the fibre.

Papers The New York Herald of Today publishes a long descriptive article on the electric Rail road and its adaptability to the N.Y. Elevated Roads. Daily Graphic Artist drew and took some photographs of electric Road & car

Rail Insulation. The road was again tested this morning and found to be loss between tracks, in comparison with the leakage shown yesterday it would show that the thorough soaking of the under wood of the ties, conducted across more of the current than any amount of warm wet sands.

Two rails were laid regularly on sleepers in corner of Laboratory &c for the purpose of tests and experiments on insulation.

Bamboo Case, tested at 48 candles and lasted 68 Minutes. the blue in this lamp disappeared after it had been burning a few minutes and did not again return. A Regular Bast was then tested on reverse current and burned 94 Minutes Book No. 112 page 15 &c.

Small Engine from Lamp Factory shipped to Hudson Michigan

Pat Office Drawings. Mr. Edison sketched several devices and systems for introducing extra wires at different points in a circuit for maintaining the electro motive force. Also two devices for holding carbon loops and for plating the ends with metal. ~~Also~~ a new draughtsman set at work.

Insulating wire. Mr. Clarke made a diagram of a machine for wrapping with strips or other material the cables of the light circuits. it is a turn table plate ~~with~~ on a sleeve through which the cable may pass. and the plate having the spools or bobbins of material secured near the perifery. revolves around the cable or wire, it is run by hand with crank and proper gearing and is moved along the wire or the wire may be carried through the machine. it is made to fit varying sized cables by movable or sliding centering pieces.

Visitors Rep of Herald also a large party of ladies who were taken several trips over the road.

Papers. Herald of today also has an article, purporting to be interviews with officers of Elevated Rail Roads of New York on the subject of electric roads concerning their adaptability to elevated roads.

Lamp lines. Hickman was set at work on the 25 wire cable, winding it with strips of muslin, preparatory to tarring for better insulation.

Fiber cutter. The fiber holder or clamp for shaping and cutting was tried. The single bar in the center was found to spring the bars so it did not clamp evenly the whole length, and a step piece was cut to bring the bearing near the ends, but it was found that the wooden base then sprung. It was decided to get a cast base and ~~press~~ the clamp together with a double solid right angled lever ~~acting~~ ~~under~~ with the bite coming up in front of the former ~~perpendicularly~~ and the lever arms extending under and back. worked with treadles same as before.

Carbonizing Former. Andrews is making a former for carbonizing threads leaving the inside piece loose instead of riveted as in others, and with a light weight fitted to press the ends down flat and prevent them from warping or curling out of shape, instead of the ends drawing up they are permanently secured and the loop contracting draws with it the inside piece which at the time keeps it in symmetrical shape. Mr Batchelor has today been testing one in which the ends were clamped with light weights which were drawn up as the carbon shrunk, but did not give entire satisfaction.

Oil carbon. A very interesting experiment was made today by immersing a carbon loop clamped and connected to inner tubes in kerosene oil and brought up to incandescence by the current, bubbles of gas or air were emitted from the carbon in at high heat the oil (assumed a smoky look) appeared to be infused with carbon, On removing the carbon it was found to be considerably

increased in size. greyish in appearance, and perfectly homogeneous. it was placed in a lamp, exhausted and burned at 16 candles ~~the~~ 14 minutes when engine was stopped.

Work general. Mess preparing the gas carbonizing furnace by putting in the gas and blast pipes and fixtures. Clarke on Electric Locomotives Mr. Batchelor on carbons and apparatus for carbonizing. conductor gang uncovering. Street lamp circuits. Men finishing up gear for electric locomotive.

Bast Fibres. Two bundles rec'd from Baltimore Md.

Rock Drills. Yesterday Mr Batchelor at work on Electric Rock drill and devised & sketched several applications of the electric motors for that purpose. using in most cases gear and cam movements, the important one on page 56 of Book No. 102, the drill in connected direct to the revolving armature, and is thereby capable of being run at 2000 or 3000 revolutions per minute. and with lateral stroke of probably one half inch imparted to it by a lifting cam, and having a short stroke is capable of acting rapidly, and rather incessantly pecks rather than striking heavy blows. Sketches Book No 102 pages 47 to 59 inclusive.

Kerosene carbons. The experiments with carbons &c in Kerosene oil have been continued to day and the lamp prepared and partially tested on Saturday was put at about 350 candles and lasted 13 min. the resistance was reduced when at that

heat to 7.2 ohms took current of 50 ft pounds per candle or 700 candles per horse power. In this case the resistance was too low to permit of practical sub division of the current. Several attempts were made to deposit the oil carbon on platinum wire but in all cases the accumulation of the gas at one point on the wire caused it to melt and separate in one case however a pretty fair deposit was obtained and under microscope showed very homogeneous. It was given to Dr Haid with directions to attempt the removal of the platinum by dissolution leaving if possible the carbon in exceedingly fine tubular form. In one experiment the glass broke leaving the carbon whole which was measured by Mr Batchelor and found to have increased from .012 to .020 h or about four times the bulk. A Bast carbon was then treated by heating hot twice in oil and put in lamp. put at 48 candles. resistance 81.5 ohms took 833

Volts and gave 8.75 per horse power. No record that I can learn was kept of its life. Book No. 137 pages 53 &c.

Rail clutch. The friction rail clutch devised for the purpose of electric locomotive was tested today by having one made of wood and tried on the rails. It takes a good firm hold of the rails and has very little back pull after clutching. The only objection being the sliding friction of the forward motion to obviate which Mr Clarke devised and sketched in Book No. 115 page 57 one with rollers ~~another~~ to carry the weight in the forward movement, also to clutch with roller on an incline.

Blast pipes. A blast pipe was run into Dr Haid's Room from the box leading to furnace to be used by Dr in gas furnace for assaying purposes.

Carbonizing former with loose center, fine tied, the ends of the carbons are secured and lightly weighted, and the central piece acts as a weight which is drawn down by the shrinkage of the carbon

42 July 26

which is kept in shape by contracting
around the sliding, central, wire.

Black Sand exp. Shallow tub moving back
and forward rotary motion by two
Eccentric ~~from~~ shaft and with round
pipe, perforated on inner side, was put in
position near small engine room and air blast connection made
ready for trial.

Spark Lamp. A regular lamp had a
platinum wire sealed through the
globe, on the wire was clamped a short
piece of carbonized fibre which extended
to within about one half inch of the
regular loop. I judge for experiments
in attempting to build up carbon loop
from the strip carbon by sparking
across.

Visitors. A couple Cuban R.R. gentlemen
for information on elec R.R. and the
cost and rights to uses also Puskas
and Friend and Mr. Wilber.

Absent. Samuel Edison left for Fort Gratiot

Tuesday July 27. 43

Spark Lamp. described yesterday was tried
to day, by connecting the lamp regularly
in the circuit in Photometric room and
four batteries. through the induction coil,
connected one wire to one of of the lamp
wires and the other connected to the
platinum lead in the globe and to which
the carbon strip is clamped, the spark
~~could only be~~ was only susceptible by the
"blue" or disintegrated carbon, and that
only slightly. The attempt to build up
the carbon was to all appearance unsuccessful
and the loop broke in a short time.

Black Sand. The Tub device for experimenting
on sand separation by air blast, described
yesterday was tried today. but ~~not~~
from the blower here sufficient air, pressure
could not be ~~forced~~ obtained through the small
perforations to fully test the apparatus.
It was then removed to the other side of
laboratory to be tried as a washer, using
water in the pipe instead of air.

Carbonization. Mr Batchelor has been to day experimenting with benzene, Paraffine, and powdered coal, in the moulds, to learn whether the hydrocarbon would form & unite with the vegetable carbon similarly to the union obtained by the submersion of the loop in kerosene, In all these trials the carbons came out nice and looked very homogeneous. the one in coal looked under the microscope looked as though the small particles of coal had attached itself to the loop.

None were tested in lamps to day.

Test Mr Upton made a test of a regular Bast carbon lamp fibre carbonized in new former. At 16 candles 120.15 ohms. 13.5 per horse power, At 48 candles 110.6 ohms and 9.1 per horse power. Lasted at 48 candles 67 minutes Book No 112 page 57 &c. Also made calorimeter test of regular old Bast Lamp. Book No 112 page 53 &c.

Visitors Prof Barker & friends. Also Mr Lowrey, and for Prof. the box car [illegible] hand and journal heater.

Carbonization. Mr Batchelor is continuing the experiments with various products and other substances in the moulds during the baking process. No further tests have been made today, in carbons, in lamps. Made tar chemicals in Note Book No 105 page 13 &c.

Lamp Factory. Schuyler setting in the Lower Vacuum pipe and 2nd frame [illegible] for glass blowers tables. [illegible] rubber tube connections between pumps and Mercury pipes.

The motor on power pump was connected up and tried it worked all right and with the pump and sealing in no [illegible] was put in the pump.

Tub Separator. Mr Force made the necessary water connections to try the shallow tub on washer, The preliminary trial worked well enough to warrant removing the apparatus to near small engine room where power may be applied to rotating the tub.

July 28.

Rail Road. Three dynamos were put in series today and the current applied to the rail road track, the motor was tried and found, show more power and speed and to be much easier on the Dynamos inside.

Telephonic. wire was to day run by Mr from office to Mr Edison's Office and telephonic communication opened. for purposes of quicker telegraphic communication. Mr E. proposing to have the Tel office in connection with Post office.

Roller clutch. Mr Clarke completed the details and drawings of roller clutch for locomotive. and proposes having wooden model made for testing its efficiency.

Visitors. Another one of the London telephone men

Thursday July 29. 1880

Rails. The rails laid in curves of Saturday last are lengths were tested by Mr Upton and found 8900 ohms between the rails the ties and mass were then pulled from contact with the rails and three ohms additional were obtained.

Roller clutch. John Ott is ~~making~~ made a working model from the drawings by Clarke to test its efficiency. The rollers one on each side work against inclines and is thrown against the one or the other by an eccentric on top of frame which moves an additional light frame to which are secured four eliptic springs which extend through the frame and have one of their ends bearing on the rollers. And by turning the eccentric the springs are made to act to hold the rollers against either of the inclines desired or it may be set so the rollers remain in apex of the inclines and free from the rail bed and would first start. And would [illegible] much better on curves than the former one

Dynamo Shaft. One of the bearings ~~filled~~ of the Dynamo shaft, which had been filled with Babbit metal was found to have worn out and was taken down and run with same metal. And a fourth dynamo was put in position and prepared for the test.

Carbon tester. Mr. Edison gave Kruesi a tracing of ~~apparatus~~ sketch [illegible] ~~for testing carbons~~ with directions to make the apparatus. It is composed of a large globe connected by tube to four separate pumps which are designed to be kept running to maintain high vacuum in the large globe. To the opposite side of the globe is another tube with stop cock running to a smaller glass globe ~~[illegible]~~ arranged to hold the inner tube and carbon, which is secured therein and made air tight by passing the tube through a rubber ~~stopper~~ and flooding it with mercury similarly to the trap or flooder used on the pumps, The stop cock may then be turned open and it is believed that the large globe will exhaust the air sufficiently from the small

globe to permit of immediate heating sufficiently to note any irregularities,

Carbonization, Mr. Batchelor has a ~~[illegible]~~ made to hold the six inch fibres, and with a 5/8 inch wide sliding center piece, out of which he took some nice carbons, One lamp was made with the 6th carbon: cold at 16 candles had 188 ohms resistance at 71 candles had 170 ohms resistance and burned 62 minutes, broke 12, [illegible] 64%. He has been using pipe clay around the lid of the moulds to more perfectly exclude the air,

In the evening Mr. Batchelor drilled in the mould and connected a pipe about two feet long. Some pieces of tissue and [illegible] carbon were put in the mould and in the furnace, at high red heat gas was turned into the mould through the pipe and allowed to burn for awhile. The carbons on being removed were found covered with lamp black or soot, due to too low heat on mould. which was put back and gas turned on at white heat, in this case the carbons were much better and assumed the grayish appearance which indicates the addition of hydrocarbon to the [illegible] carbon.

Papers. Dailys to day have very favorable telegraphic reports from Hendersons chief engineer Steamer Columbia, concerning the stability and satisfactory working of the Edison lamps and generators provided for that Steamer

Carbonization. Safety globe were placed ~~on~~ sand and gas flame applied, in the globe was placed some gasoline and the generated gas conducted to one of the moulds in large furnace: in one of the trials the carbon strips came out a beautiful silver grey [illegible] homogeneous and showing the augmentation by the hydrocarbon of the gas.

A glass chamber was made in which a tube with clamped carbon can be placed and by rubber stopper through which the tube passes made air tight at bottom, in one side of chamber near the bottom is a tube through which the gas may flow and at top is another tube for outflow and burner, the gas from the apparatus used for above experiment was

ignited at outflow tube and the current turned onto the loop, the first experiment the current was kept on at low heat for some time. And the carbon ~~had been~~ was largely increased by the hydro carbon of the gas. The second trial the heat was put very high and put on and off a few times leaving it on but a moment at the time, In this trial a Bact 6 inch carbon was used and came out perfectly even and a steel grey it was taken by Mr B— to the glass house and immediately sealed in a lamp.

Magneto calls. Bergmann and Western Elec. magneto calls. bells were tested by Mr Upton and we ~~preference given~~ [illegible] the Western Electric prove best with the present methods of construction, Book No. 37, pages 25-8 &c.

Dust coal. The furnace for burning dust coal is completed and ovens with coke therein; The openings or communications are yet to be made ~~with~~ to the boiler fire box-

kerosene vapor: a tube or long and narrow was sealed to a globe parallel therewith, by a small piece of tubing. in the narrow was placed about a gill of kerosene, and the opening closed by a flooded rubber stopper. And the whole placed on a pump and exhausted. when pretty fair vacuum was obtained the oil commenced to boil, small bubbles coming up through the oil and covering the surface. when high vacuum was obtained the oil suddenly ceased bubbling, on sealing the lamp off it was tested and found to have collected and formed additional carbon from the oil vapor, and that the resistance hot was but 28½ ohms, took 72.5 volts or 13000 ft lbs at 16 candles, very uneconomical. Book No. 112 page 89 &c. The inside of the globe was also coated with carbon after burning a few minutes.

Wire insulation. Boys are winding the 25 wire cable with tarred twine in addition to the muslin and tar already put on.

Drain Pipe. A drain pipe was put down from the small engine house to and connected with the main drain pipe running through the Laboratory yard.

Dynamo. A [illegible] dynamo was set running for current to supply the pump so that R.R. running would not interfere with the work of the pumps.

Night work. Orders were given by Mr. Edison to run nights and the engine was run till twelve o'clock at night. Mr. Batchelor and several of the men worked all night.

Visitors, Mr. Wilber also Mr. [illegible] patentee of visual fire alarm indicator and annunciator, of which Mr. Edison expressed high opinions.

Saturday July 31-

Mercury— Another Flask or over 1100 pounds of mercury was received at the Lamp Factory for the vacuum pumps.

Rail insulation. The lengths of rails in front of laboratory that were insulated by pieces of hard rubber being laid under the rails and strung up over the [illegible] And iron washers placed thereon on which the spike heads would rest. Finished so late that no test was made.

Gas furnace. One of the small square gas furnaces for carbonizing was set up in the chemical laboratory and gas connections made with the main pipes.

Gasoline Vapor. The six inch carbon treated in Gasoline Vapor last night and put in a lamp was exhausted and tested to day, at 16 candles 90.4 ohms resist. 88.3 volts. or 8.6 per horse power, Book No. 112 page 99 [illegible]

July 31st 80

Work during past week, Messrs Edison and Batchelor making some interesting experiments with carbons and rods of carbon and means of carbonizing. Andrus making carbon forms of different devices for use in the large 80 carbon moulds of gas furnace. Dean making the clamps and [illegible] for four six and eight inch loops. [illegible] Clarke on electric locomotive. insulated car wheels and roller [illegible]. [illegible] the [illegible] days drawing specifications. Cunningham making glass heater on the device for holding tubes for heating over gas flame, (described under date May 28) Several tables fitted for glass blowers at Lamp factory. Hammer making the rubber connections between pumps and mercury pipes. Conductor gang wrapping and tarring the 20 mile circuit. Carpenters building the large magnetic separator.

Absent Messrs Edison and Batchelor went east on 3 20 train.

Monday Aug. 2.

Fiber tester Mr. Batchelor devised an instrument for testing or proving fibre Sketch Book No 105 page 35 &c. It consists of a metal base or table darkened, and on which the end fiber may be secured, a folding magnifying glass has a groove of about .012 diameter cut across the part forming the base when opened ready for use, in the hole in the base are secured a couple metallic pieces with the ends approaching to precisely .012 of an inch of each other. After securing the fiber on the table the glass and frame may be passed across the fiber and any variation in the diameter as indicated by the two metallic points or gauge can be observed through the magnifying glass

Pump motor. The dynamo motor and empty pumps at lamp factory were run some time today to polish up and loosen the bearings &c.

Gasoline Exper. The lamp made with carbon treated in gasoline vapor Friday night was tested again today, after burning at 16 candles for a very few minutes a black spot appeared in the top and at 7 candle [illegible]

Calorimeter test. Mr. Upton made a calorimeter test of a paper carbon lamp, and then dipped it in tar, and dried it after which another calorimeter test was made the darkened globe made practically no difference in the results. Book 12.13.

Support for dynamo shaft put in yesterday.

Drop tube, one of the new pumps which has been in nearly constant use for about four weeks was observed to be cracked in the fall or drop tube where the drop strikes the solid mercury column, the crack extended for a length of about six inches and appeared to be caused by inside action, and is undoubtedly due to the incessant pounding of the mercury.

6 in Bamboo. Lamp burned 3 hrs 24 min at 71 candles and gave nearly 7 per h.p. the best lamp we have yet made from vegetable carbon Book 112 Page 119 &c.

Tuesday Aug 3d

Papers. Herald of today publishes sketches and comments of Mr Edison & the captive balloon experiments in connection with a long article on aerial navigation

Engine, the engine fell in new hands today by Hood the engineer very unceremoniously leaving, "California" taken charge.

Gas furnace, connected with blast and gas pipes in carbonizing room, the blower did not give sufficient air blast so one of the glass blowers tables and bellows were carried in and the furnace heated. One of the large moulds for 30 carbons was put in and on first trial it was found that the gas had gotten in around the jointed base and formed a sort of tar which held the carbon together. Mr Batchelor then drilled a small hole in top of mould and used pipe clay around the base & lid and the second trial with mould thus arranged the carbons came out first class

Mercury, The flasks of mercury were taken to the machine shop to start the stoppers after which they were returned to the Factory and Hammer set at cleaning the mercury preparatory to putting it in the pumps.

Research. Dr Moses has been engaged now nearly a week in searching the scientific books of the office Library for all extracts connected with the electric light and lamp. carbons, vacuum, &c. See Books No. 127 & 128.

P.O. Drawings. The new draughtsman in Mr. Serrell's office has now on his table, sketches by Mr. Edison of the following devices from which to make Pat Office drawings. A lamp with wires sealed through two small buttons on a stem of solid, or a tube of, glass the upper or inside button and glass stem being a support for the wires and the bottom button through which the wires are sealed is then sealed with the tube of outer lamp

globe to form the vacuum chamber. Another with wires sealed along the outside of the inner tube or stem and admitting of sealing at any point with the outer globe. Another with a small globe at bottom of the large one, through which the wires pass and are twice sealed and which is also exhausted simultaneously with the lamp globe, so that in case of leakage at ~~the~~ either point of sealing the lamp remains unaffected. Another lamp with a single straight upright carbon held at top in a metallic oval brace to which the upper end is clamped. Another with two straight upright carbons approaching each other at top and there clamped together. Another with two carbon loops set at right angles to each other. Also a worm or spiral carbon with apparatus for carbonizing the same. Also the carbon former with loose center and end weight to which the ends of the carbon are secured with small

pins. And also a sketch of the device for treating carbons in gasoline vapor as described under date July 30.

Visitor Mr. Wilber here all day.

Fiber clamps, or formers. One pair for six inch fibers with each face and under lever for clamping were finished by Dean and set up on Bradley's bench. Some fibers were taken out of them and carbonized very nicely and are very convenient and effective and work satisfactorily. See July 14.

 Wednesday Aug 4. 1880

Making Bamboo. Wm Wright is making an instrument for splitting out the Bamboo. On either end of a steel bar a long side or slot is drilled through the steel and the metal on each side of the slot is then rolled down to an edge, very thin and bevelled only on outside. Dean is making some more of the rough trimmers or instruments for shaving the material down to required thickness.

Carbonization The gas furnace has been in use to day and with the formers in the furnace this day the carbons were gotten out safely and the furnace gives perfect satisfaction so far. One of the carbons gotten out on first trial was put in a lamp and stood well through the heating on pump and in the test it was then set at 48 candles but was accidentally broken by falling

Aug 4.

In test 178.1 time at 16 candles and 161.6 time at 48 candles Book No. 112 page 200 &c.

Straightening Carbons Some of the longer carbons have at times bent over to one side very much after they had been placed in the lamps and heated. To straighten them the lamp is placed between the poles of an electric magnet and the current turned on the lamp. One pole attracts while the other repels the charged carbon and the lamp is placed between the poles in such position relation that the polar action is utilized to straighten the carbon through the glass globe. I find that this "little dodge" has been worked for some time but to day is the first I have caught them at it.

Mercury. The mercury used for the pumps is exceedingly dirty and Hammer is still at work cleaning it.

Note on Gas furnace, with additional device for the carbon formers. Book No 105 page 39 &c.

Carbonizing &c / Notes on Gas furnace } The Gas furnace has been doing excellent results to-day and Andrews is drawing plans for the moulds which are intended to hold about thirty, eleven of which are completed and in use.

Find in Book No. 105, page 39 &c Notes on carbonizing and particularly on the Gas furnace and Carbon formers, &c made during last night and to-day, in which he suggests to make the furnace in sections, also to connect the gas through rubber tubing so the burner may be removed out of the way when not burning. And also some additional sketches and description of weighting and forming shape of carbon.

Paper— Herald to-day describes Stephen Dudley Field's electric engine, application filed June 9. Patent issued July 13. Caveat claimed to have been filed one a year previous. Article states Edison's engine first tried May 14— which is not so— is a mistake

Mercury Pump. The power Mercury pump at Lamp Factory was tried to-day with mercury. Quite a number of leaks were discovered in the joints of the pipes &c and at the nipples. And it was very evident that the belt on the cone pulleys would not answer for gear. The belt was slipped every time an effort was made to start the pump with the power from electric motor, which showed a willingness and power to do its work.

Clutch gear. Discovered to-day in Book No. 135 page 65 &c, under date Aug. 3 a sketch by Mr. Edison of a clutch designed to work on the driving wheels of a locomotive instead of on the rails. Also some notes and reminders of matter to be incorporated in patents.

Kerosene light / Cost } Lamp registered to 8 candles, after burning, the heat raised it to 11 candles. After burning 7 hrs it had consumed 11 fluid ozs oil. .090 Gal, per hour, per candle Book No 112 page 213.

Friday Aug. 6.

Paper. I heard that the Silver Lake Co were to day had a reported difference with Field in relation to the electric engine could not find a paper to learn any particulars.

Pat. Drawings. Mr. Edison made sketches (pumps) of Pump and electric motor connected, also of electric locomotive which was given the draughtsman [illegible] to make Patent Office drawings

Rail Road. on second trip to day the motor was found to work badly and upon examination it was found that a cross had formed on the washer between the commutator brush holder and the block holding the two brush holders by metallic dust accumulating upon it. it was remedied and on the next trial not working satisfactorily it was on examination found that the wire of one of the magnets had crossed with the base and ~~then~~ it was found necessary to remove and rewind it. One of the armatures of

the dynamo was also burned out but the Armature has not been unwound and I was unable to discover or learn the point or cause of the cross. the principle burn seems to have been on the commutator Horns.

Leaning Lamps. Mr. Batchelor gave his views of the cause and possible remedy for the lamps leaning or bending over on one side after heating in the lamps. believing it due to unequal heating in carbonizing and a resultant unequal contraction in the lamp by the heat. Book No. 105 page 55 &c.

Telephone receiver. John Ott put a screw or worm gear in the shaped receiver to get more power and less speed on the chalk.

Friction Ratchet for transmission of power described and sketched by Mr. Hornig. Book No. 101 page 11 &c.

Visitors. Lieber. Goddard and Gouraud acquaintances of Mr. Edison.

Absent. - Mr. Upton went east on short visit to family.

Saturday Aug. 7.

Locomotive. The magnets were taken out of the locomotive ~~and wagon~~ to be [illegible] And the one crossed with [illegible] wire [illegible] and rewound: And now that the engine is apart and the gear about ready to put on, it will be equipped with [illegible] substantial gear before replacement in place.

Visual Indicator. Another of the large visual indicators was brought and set up by McKenzie.

Usual routine, for past week. [illegible] drawing coal dust from the case of which he [illegible] laying on the switch for Mr. Edison. [illegible] continuing work cleaning out the [illegible]. [illegible] remodelling and putting screw-gear in telephone receiver. [illegible] making forms in which to cut Bamboo fibre. Mr Batchelor carbonizing and experimenting on apparatus for that purpose And has worked it around "wire". Mr. Wilber [illegible] most of the week setting up specifications. Men preparing Lamp factory for occupancy, by putting in the final trimmings,

[illegible] McGowan [illegible] this O.K. to [illegible] & remainder to [illegible]

Monday Aug. 9.

Engine & Boiler } The caps were [illegible] from the boiler tubes and then at work all day [illegible] and last night scraping and cleaning the tubes and [illegible] at work [illegible] the necessary [illegible] [illegible] the coal [illegible] [illegible], preparatory to using the dust when again fired up. Mr. Batchelor was there and took a look at the arrangement and had one of the tubes [illegible] made examination of the tubes &c.

Carbonization. Mr. Batchelor yesterday made memorandum of the experiments to be tried with different heats &c. to discover the cause, and possible remedy for [illegible] the carbon loops bending to one side, (Book No. 105, page 61 &c.

To day all attempts at carbonizing have been discontinued at the Laboratory and Mr. Batchelor and Van Cleve, are preparing the table and putting up the gas furnace at the Factory.

Paper. New York Times to day, publishes a fair and favorable two column article on Edison. Light & electric Rail Road." &c & head.

Engine &c } Power not running to day. and Shop } Men still at work on boilers &c. and Logan at work at putting the gear on the electric Locomotive. Kruesi taking advantage of the lull by having some of the tools and hangings of shafting and lathes cleaned and overhauled and some of the machines shifted and newly And for a few days hence, business appears to have gotten the upper hand of Invention, & experiments and important items for record are correspondingly scarce.

Stationary electric engine. Hornig is working on the details of a stationary elec. eng. in which a connecting rod from the eccentric or crank on armature shaft works upon an arm extending from shaft of driving wheel to the periphery thereof and then propels the same by a friction clutch acting on the periphery, and the speed may be governed by the distance between

the ~~the~~ joint of the connecting rod and the arm, and the clutch on periphery of the driving wheel. The design is for any use to which a stationary ~~station~~ engine is ordinarily assigned.

Absent. Mr. Clarke gone to Philadelphia & Mr Upton still absent east.

Teleph. central Station. Six telephones were received from Bergmann this morning to be set up to demonstrate the call or central station system in the use of Ponds visual Indicator, to denote the No. of subscriber wanted and the drop also made by Bergmann to indicate the No. of the caller. The instruments have been placed at different points about the works and work quite satisfactory.

Dust coal furnace A light fire was started this afternoon in the furnace for burning dust coal and will be kept low all night to thoroughly dry the mason work and be ready to test it thoroughly in the morning on getting up the steam.

Gas House. Lelonde here to day and put the Oil &c in the tank of new gas house at Lamp Factory to have gas in readiness for the Root pressure blower to give it the pressure in the tomorrow if the engine is run.

Old Paper Loop. The carbons were taken out of a couple of the old card board Lamps that had burned a long time and carefully measured by Mr. Batchelor. On face 0.063 of a sq inch as surface of one face and 0.021 wide & 3" long Book 114 page 1.

Machinery. a new large lathe and very large drill press received and set up in shop

Dust coal furnace. was fired up strong to day and held 65 lbs of steam for about 1½ hours but the arrangement was very uncertain. pumping water in the boiler reducing the steam pressure, to about 40 lbs. and opening the doors in front of boiler produced almost an instantaneous fall in the pressure. in the evening the pressure fell to a very few pounds in spite of their best efforts. (unless it proves more stable and reliable tomorrow. the grates will be replaced under boilers and the experiment discontinued for the present) whether the unreliability is due to the inefficiency of apparatus or inexperience of men. in attending it remains to be determined.

Work orders given by Mr. E. to run and work day & night as long as there is a man here to attend it.

Gas Works. The Root blower at Factory was started and run to day and appears to be efficient enough for the work required of it there. but the gas apparatus seems to be totally inefficient to supply the glass blowers jets now up. independent of the carbonizing furnaces. which are also to be supplied with the gas.

Carbonization. Mr. Batchelor is to day carefully making the experiments on heating the carbons differently and at different degrees in the muffle furnaces. in pursuance of the notes Book 105 page 61 &c. to determine if possible the cause of loops breaking &c.

Lamps &c. Memoranda of work to be done and preparations to be made to start if possible. 200 Lamps on Friday Book 112 page 257 &c.

Visitors. a Reporter of the Times.

Absent. Mott C.P. in New Brunswick all day on some business at County Clerk's office for E. & B.

Paper Herald to day publishes a lengthy acrimonious letter from Sawyer in which he positively contradicts all ability on part of Mr Edison to make Lamps at less than two or three dollars apiece and nor to maintain more than one or two per horse power, and tries to prove his hobby and mistaken idea that electric lamps must have low resistance for economy of current.

Mercury Sorrow Pump. The cone pulleys were taken down to be replaced with other straight pulleys.

Coal Dust. Sent this morning for a small engine and a Boston blower for giving blast to coal dust furnace, and had them up and started by about 3. P. M. It is found to assist very much. but no merit has yet been demonstrated to enlist confidence in the arrangement. One great disadvantage being the necessity of steam &c.

Telephone calls. Bergman made the alterations suggested to him here some days ago on his Magneto call and connected telephone therewith and sent one here to day, it was tested by Mr. Upton and found to work very well. No. 114. page 81.

Call box. John Ott is making a working model for an automatic call box for the Area Indicator &c. designed to be used in the telephonic central system and is designed to call any number desired by the caller or operator.

Carbonization. Mr. Batchelor's experiments with different heats did not solve the problem or reveal the cause of the loops breaking over. A thorough discussion to night suggested the theory that it might be due to the fact that the way the present loops are cut and carbonized the pith and outside of the Bamboo always comes on

the side of the loop. and to ~~test~~ the theory whether the pith side, being more loose and porous than the outside did not shrink more ~~from~~ the effects of the heat, than the more firm and compact outside. It was determined to change a Carbon forming mould so that the widened ends might stand ~~parallel with~~ at right angles with the face and thus bring the pith either on inside or outside of the loop. The mould was thus arranged and between twelve o'clock and morning Mr Batchelor got out three or four. had them put in lamps exhausted and heated very high and to the gratification of all the loops remained uncut and they justly feel that the problem is solved and that carbonization is now worked to a fine art.

Book

Absent Mr Edison East probably in New York all day in ~~each~~ Myself in N.B. all day. Wilcox here intended

Carbon Formers. All the blocks used in moulds as formers or shapers for carbons are being changed by Andrews so as to hold the widened ends so the thin edge of them will stand towards the faces in the lamp. by which means the fiber will in every case be bent so that the inner or pith side of the fiber will come on the inside or outside of the loop instead of on the face as formerly.

Meters. Mr. Edison wrote descriptions and made sketches of several new forms of electric meters in Book No. 132, page 1 &c.

Absent Mott at New Brunswick and finished up the work recorded Book 136, page 1 &c Mounted Lamps Lots.

Saturday Aug 14-

Patents Mr. Wilber took with him to Washington several Patent specifications and left with Mott for copy, The Specifications for Edison Electric Rail Road to be sent to foreign Countries.

Furnaces. Mott sent to Woodbridge to order Three Gas furnaces for carbonizing to be made with the square holes, for vent in the top of the lid instead of the side and to have two one inch bands one around the lid and one around the furnace. goods promised to be delivered in 10 or 11 days.

Gas Apparatus. The gas Apparatus at Lamp Factory not giving satisfaction one like now used at Laboratory was ordered in the mean time Patrick Clarke has small boiler there to further experiment on his machine by heating the water.

Work general for past week. Mr. Batchelor experimenting to determine the cause and devise means to prevent the long carbons from bending over sideways in the lamps, found the cause and remedied the defect by removing the cause. Men under Logan setting the cast gear on the electric locomotive. Trying the experiments with the coal dust ~~experiments~~ furnace and experienced great delay and annoyance by it, N. E. Testing the Blower and Gas supply at Lamp Factory, the former efficient but the latter has neither capacity nor simplicity for practical use there. Men wrapping conductors with muslin tarred and then wound with marline and again tarred. Mr. Wilber here several days at work on Patent Specifications

Monday Aug 16.

Meters Yesterday Mr Edison made sketches of several different forms of meters and means connected to lamp for measuring the electric current which were given to Mott from which to make Patent office drawings for caveat.

Factory Bradley set seven boys at work in the Lamp Factory on Bamboo working it through the different stages preparatory ~~for~~ carbonization.

Coal dust. The engine is still running this morning on coal dust and has improved somewhat through more experience of the tenders. but the improvement does not warrant longer trial and at five oclock the engine was stopped and men set at work removing the masonry from the boiler fire box and replacing the grates preparatory to return to old principles
About Kreusi at Philadelphia

Aug 16.

Fruit in Vacuum. Mr. Edison had Boehm seal some fruit in a chamber arranged to exhaust on the pump. in a couple attempts the fruit was injured by the heat but one pear was enclosed with slight injury and after exhaustion was hermetically sealed. and taken by Mr. Edison. I judge the experiment to be for purpose of testing or observing the action of the fruit when thus treated.

Bamboo Splitter Dean furnished a machine for splitting out Bamboo in which the knife is secured on a block of iron as a slide or carriage which block is then secured in a carriage frame and is drawn down through the bamboo lengthwise by a treadle after which the knife is raised to its first position by a spring or weight and pulley. The bamboo is held in place on a base by two half circle blocks one concave for outside of bamboo and the other convex for the inside of the hollow bamboo. Which blocks are held firmly against the material by a strong spring.

Lamp tests Quite a number of miscellaneous lamps were put at 32 candles up stairs in Labratory, to test their staying qualities. the carbons were taken without regard to perfection and all those having spots went first. some of them lasting four to six hours.
Book No. 123 page 142.
Some of the old lamps made six or eight months ago and burned a long time last winter were examined for vacuum by a sparker, or Induction coil and the ones sealed with white or annealing glass and those with common glass extended along the wires had retained much better vac. on the average than those plainly sealed through the ~~plan~~ thin glass.
One of the long bamboo carbons in a lamp No. 1360 ~~burnt over~~ after burning about two hours burnt over till the carbon touched and blistered the glass but burned in

that condition about half an hour before the carbon broke.

Gas Apparatus. Mr. Edison had Boehm make an apparatus for making gas and giving equal steady pressure to it, which is compound of a bottomless bottle placed in an open jar in which a quantity of mercury is placed, and the bottomless bottle forced and weighted down therein. the gas is generated from Sulphuric acid ~~&c~~ placed in a suitable reservoir and set in a hot sand dish. from the generating reservoir the gas is conducted through a glass tube over top of jar down to and under bottom of bottle thence up to and above the surface of the mercury where it is set free in a pressure reservoir formed by the top of bottle as top and sides and the mercury as the bottom and made gas and air tight at top by a rubber stopper flooded with merc[ury]

through which by another glass tube and rubber hose attached it may be conducted where wanted, in the present case to a chamber for holding the clamped carbon loops, which may be filled with the gas and the carbon heated by current either for test or for accumulating hydro carbon thereon sketches Book No. 68 page 191 &c.

Carbonization Van Cleve made the commencement at carbonizing in the Factory to day and from first mould of twelve carbons and former got out eleven in nice order, and from second mould of fifteen carbons got 13 out successfully.

Bamboo straightening. Mr. Batchelor placed two split pieces of Bamboo about 1/3 circle on an iron plate mean 20 lbs weight and burned two ~~gas flo~~ bunsen flames under the plate to see whether the circular parts would flatten under the influence of the heat and pressure, but the Bamboo resisted all efforts

Visitors Herald Fox- here in evening

Glass. Two boxes of tubing from Corning N.Y. glass works received at Factory and upon test by Holzer, pronounced very good glass for the purposes of the lamp.

Bamboo. Four bundles of common Bamboo were rec'd. this morning and cable prepared to send to Japan for a quantity of large Japanese Bamboo.

To further experiment on straightening or flattening bamboo Mr. Batchelor had some prepared same as yesterday and in addition to the weight and heat had the hot steam (above boiling point or a little above) playing on it for a couple hours but without avail, his belief is that with very hot steam, the bamboo might be softened sufficiently to yield to the pressure and be flattened.

Carbon Several bamboo strips were cut eight by sixteen thousandths, and put in lamps so the thin edges would form the face of the loop: idea to more effectually prevent their bending over.

 Aug 18.

Reverser. Mr. Edison sketch a modification of the cylinder current reverser reduced in size to make it applicable to each individual lamp in which it is used to put on or cut off current and being always turned one way; the current is reversed through the loop at each lighting. Sketches was given to Dyer for caveat drawings.

Absent Messrs Edison and Clarke took 7.35 train to Philadelphia and returned about three thirty.

Visitors Col Liao brought some choice select fruits to be sealed in vacuum.

Thursday Aug. 19. 1880

Factory. Four young men set at glass blowing at Factory by Holzer, Men commenced boarding up fence around lot there. W. L. Clarke lit all the gas burners and burned them for forty minutes to test the capacity of the Clark's gas apparatus. Van Cleve changing the form of the stands for gas and air for carbonizing furnace, so that the main gas pipe taps the stand pipe between upper and lower burners to give more equal flow or supply to each.

Armature. The armature of the machine used for supplying current to the pumps in Laboratory, mysteriously gave out this morning and no external examination or test would reveal the point or cause,

Vice. Mr. Batchelor devised and sketched a convenient little vice for holding and bending the wires after which they may have the threads cut and clamps secured thereon without removal or reannealing
Sketched in Book 102, pge 73 &c. Now being made by one of the men in Shop

Lamp test. The lamp completed last night. with a carbon full usual length but 0.008 by 0.016 was tested by Francis At 10.66 candles Resistance 210 ohms. and 8.4 per horse power. At 32 candles 188 ohms Resist and 5.6 per horse power. Book No. 104 pge 48.

Lumber. Mott went to Metuchen to see Freeman in relation to fence lumber, that now delivered being very poor and to be returned and better quality delivered in stead.

Fruit in Vacuum For Col. Gouraud, several packages exhausted and successfully sealed up

Armature. Another armature was burned out this morning in the same machine that burned one yesterday.

Clamp Machine. Some of castings for the clamp machine have been received and Logan is turning the base and some of the heavier parts.

Carbon tester. An app enlarged tube shaped for rubber cork and mercury flooding arrangement was connected directly to one of the pumps this morning for testing the carbons. the inner tube is passed through the rubber stopper which is then flooded with mercury, the tube or chamber is then exhausted and the carbon heated red to note imperfections. It was found necessary to have tube and stopcock connected to the chamber in order to let air in gradually after test. otherwise the sudden influx of the air would break the carbon. tube and stop cock put on but not tried

Rail Road. Men cutting the grass and weeds from the track and putting the same in readiness for test of the Electric Locomotive

Research Dr. Moses still employed in Library. And for past few days Messrs Upton & Hammer have been in there at work on mapping New York City in Station Districts &c.

Visitors Collins of Herald and a couple foreign tongued mining men with samples of ores.

Locomotive. The New gear of the electric Locomotive was run some little time this Afternoon. to grind down and wear smooth. before the test was finished an armature in station burned out, thus stopping the test or trial.

Silica deposit on carbons, with the apparatus described Aug. 17. Dr Haid has been today treating carbon in gas by heating with current the loops in the chamber through which the gas passed &. did not get the full results of the experiment.

Work general for past week. Men putting the gear on the electric Locomotive. Dean making cutting clamps & formers for Carbon strips. Andrews making carbon formers. Ott & McKenzie on call box for End indicator Upton making calculations of the conns. conductors &c necessary for a lighting station in New York, Clarke working on Dynamo Machine Book No. 116. Mr Batchelor superintending starting the Lamp Factory. Absent Mr Edison went to Ashbury Park in afternoon.

Dynamo Station Several of the men worked all day yesterday and last night putting up the heavy shaft and large pulley for running the dynamo Station. This Morning the large heavy belting was received. and power shut down in the evening for the man sent here for the purpose, to make the splices

Central station for Light &c. } Mr. Hornig finished diagram of a central station for light and power. fitted up with Porter Allen Dynamo. Engines.

Electric Locomotive, as equipped with gear ~~wheel~~ crupers was tried. the crupers did not work entirely satisfactorily but the difficulty was easily detected and can be readily remedied. by strengthening the springs that govern the excentrics or gripping blocks and possibly attaching the lever back of the center of

shoe to obviate the tendency to lift up. The friction wheel ~~however~~ at slow speed does not hold very well. would not hold sufficiently to carry the motor up the grade beyond the Pond. And heard no suggestions as to how the present wheel with so little resistance would be improved,

Armature, during the test of the Locomotive. Another and the fourth Armature, was burned out in the same magnets. so many Armatures giving out in this one Machine would seem to indicate that the magnets in some way might be the cause or partial cause of it, but that theory or suggestion does not seem to be entertained by those most familiar with the machines. one fact is observed in this machine, that I have never known of in others, and have not been able to get an explanation of it and that is that a shock may be had by contact

between the base of the magnet and the commutator brush or holder.

Call box. John Ott and McGlinzie have completed and made several trials during the last few days of a call box for the Pond indicator. In the indicator the figures are thrown in position to read, underneath the end of the box, for telegraphic characters and to simplify the operation so that any person unacquainted with telegraphy may signal. the box is an arrangement of three index slides on each of which the necessary contacts for the characters representing the different numbers are ~~represented~~ formed by raised blocks ~~or parts thereof~~ and after each slide is adjusted to the numeral desired. the contact is rapidly made by a spring ~~which is~~ with a platina point which is drawn across the raised characters by a clock work

Visitors Messrs Eldred and a friend also Col. Gouraud.

Pump. Boehm. ~~connected a carbon testing chamber,~~ made ~~to~~ a single drop tube pump. without gauge. ~~Also~~ used to day for obtaining vacuum in fruit chamber. it works very well and the experience of the men in running the gauge pumps has enabled them to judge the vacuum very accurately by the appearance of the fall or drop tube.

Carbon tester. Hill using the carbon tester on one of the pumps and is able thereby to note very slight imperfections in the carbons and reject such as are unsuitable for lamps.

Shafts & Pulleys. The shafting for the Power Mercury pump was received at Lamp Factory together with some pulleys which were not the proper size and will cause some delay in being replaced or made to fit.

Fruit in Vacuum. Col. Gouraud having sent more Peaches here to day, the boys have been sealing them in vacuum for export with him.

Visitors Wm Wilber

Short circuit. Late last night, it was discovered that severe work was being exerted on the Dynamos. and by them indicating that the lines were crossed. The engine was stopped and examinations and tests showed the cross to have in some manner occurred in the wires leading from dynamos to the Rail Road Station which were cut between the branch Factory wires and the rails so as not to interfere with the power at Factory. the cause or point of the cross was not ascertained, but these results impress one with importance & the necessity of the utmost care and attention in properly insulating and protecting the wires used as conductors.

Power pump. at Lamp Factory having been reequipped with straight pulleys and counter shaft was run empty some time to day.

Locomotive. the friction gear and shaft were taken out to improve if possible the friction of the slow speed clutch.

Ore washing Martin Force is building the experimental ore washing machine described under date July 20. and sketched in Book No 126 page 5.

Lamp Sockets. Mr. Batchelor devised and sketched several forms or styles of sockets for Lamps which may be found Book No 105 page 97 &c.

Patent copy. received for copy, the specifications for European Patent on the Lamp. its parts, and means and appliances for manufacturing the same. will comprise 30 or 40 pages.

Visitors Puskas, Collins, Wilber

 Thursday Aug 26

Gas Machine. A large "Combination Gas machine from Detroit Michigan was received at the Lamp Factory this A.M.

Pumps. Several of the pumps at Factory were found to have been broken probably by the contraction of the rubber tube leading from them to the mercury pipe above,

Hill and the pump boys are at work cleaning the mercury preparatory to starting the pumps. with other means of cleaning they are using a long tube say three feet formed with a dark crook or goose neck at the lower end the bend of which is filled with mercury and in the long straight part is placed sulphuric acid or any cleansing acid the mercury is then fed in the long tube by a drop or small stream and passes through the column of acid, which coming in contact with and adding to

the bulk of the mercury in the bent part forces ~~out~~ an equal amount out of the other end of the tube, as will be seen this apparatus causes the divided mercury to pass through say two feet of acid. the greater weight of the mercury in the short goose neck part of tube supporting a much larger quantity of the lighter acid in the long portion of tube.

Nickel clamps. Three **lamps** were completed in which ~~Platinum~~ Nickel was used for clamps instead of platinum and they were found to answer fully as well so far as observations made during to day could determine.

Glass Blowing. Boehm with his table and apparatus was to day moved down to the factory to be employed on second floor thereof.

Building. Mr. Edison made sketch plan of a 25 x 36 building to be erected supplemental to the lamp factory. for storage, packing, office, Photometric Room &c.

Paper. Herald to day contains a letter from Paget Higgs of Boston. replying to parts of Sawin's letter published in Same Paper Aug. 12. the whole being devoted to electric motors. of which he says he has transmitted 98 horse power three miles over a ½ in wire and shows by results of personal experiments and authentic published statements that Mr. Sawin is off- on electric motors

Clamping carbons, Mr. Batchelor devised and sketched a device or instrument for clamping carbons which was given to Andrews to make sketch Book No. 105 page 107. A table or bed is provided with a middle or inside part fitted to slide in grooves and is made to travel therein by a small shaft revolved by the fingers, on which is a small cog wheel with cogs fitting into a cogged or spurred strip secured on the bottom of the sliding table or carriage

On the mobile portion of table the carbon may be placed simply on the flat surface thereof or guides may be used thereon in which to more securely hold the carbons, Near the table is a smaller adjustable rest on which by spring ~~clamps~~ tension the clamps may rest and be held, and ~~after~~ when the table is moved back by the ~~cog~~ apparatus mentioned ends of the the carbon thereon will be inserted in the clamps and be secured by driving the screws with a suitable screw driver.

Insulators. Francis is making some experiments for insulation of wires underground. the material being tried mixtures of tar paraphine, and similar substances and gums in various mixtures and combinations.

Electro Motive force, Messrs Edison and Upton discussing ways, means and apparatus for determining the electro motive force or pressure in the several lines leading

Aug 27

from any central station and for maintaining and equalizing the same. Mr. Edison made several sketches of devices and means to determine and regulate, which were marked "caveat" but I could not get them to determine their nature of their operation or give description.

Absent. Mr. Upton returned from visit to his family, to whom he was telegraphically summoned on Monday last.

Segredor left for Florida and other points South to collect all fibrous woods, grasses, canes &c. that might be used or tried for lamp carbons.

Saturday Aug. 28.

Laboratory. Boys planing tables and up stairs in Laboratory and giving that part a thorough overhauling and cleaning

Patent copy finished second copys of one 27 page European application on the carbon and manner and means of manufacturing same and also a shorter specification for Milling - magnetic separator.

Conductors. Hiler and boys discontinued winding with muslin and marking the conductors to street lamps having finished only a portion of the circuits (part of the 25 lamp circuit and the Edison line) this work was commenced on the 17 July and has engaged an average of about eight hands.

~~Absent Mr. Upton left for visit to wife~~

Work general of past week. Mr. Batchelor on the drawings and details of clamp machine Dean with several assistants at work on same and on Bamboo cutters & splitters. Upton and Hammer on size length &c. of conductors for lighting station in New York. Clarke still on new form of armature adapted for large machines Smith working to improve the clutch of friction wheel of electric Locomotive

Tuesday Aug 31. 80

Building. Men digging foundation for a building north of Lamp Factory for testing proving storage &c. of Lamps.

Ground. The hole dug for the combination Gas machine is being filled up with soil, iron wire, turnings, tin cans, scraps &c. with large rod running up through to form a ground connection for testing the power to or advisability of running the motors at Factory without a return wire.

Call box. Mr. McKenzie and John Ott have finished a more complete call box for the Pond indicator which is working very satisfactory.

Dynamo Station. The ~~large belts have been~~ put on and part of the dynamos in Station belted and running. the wires to Factory having been connected to one so the power there is brought from one of the machines in station

Insulation. A couple of the boys have been winding wires up stairs in Laboratory with rubber cloth and laying the same for experiments on insulation. one bare wire tested in barrel of water gave 100 ohms and after wrapping with rubber cloth gave 120 ohms, or 20 ohms difference. Not so good an insulation as was to be expected.

Visitors. Johnson, Bergmann, Pond, Barton of Western Electric. Puskas and Bailey

Absent. Mott absent at home from Friday afternoon till this morning.

 Wednesday Sept 1

Dynamos. New belting and starting dynamo in Dynamo room, partition taken out of shop and pole put up back of station for supporting the wire for Laboratory.

Paper New York Times today publishes a letter from Hiram M. Maxim pointing out and proving the fallacy of The deductions of W. E. Sawyer, as published in his letter and not uncomplimentary to Mr. Edison

Bamboo formers. One of the heavy, hardened steel formers or clamps for bamboo was completed by Dean and sent to the Factory. Made very heavy to avoid all danger of springing and tempered to prevent scarification by knife or hammer.

Patents drew copies of Specification for English patent No 14. subject of feeding to equalize and maintain electro motive force or pressure. Also for Magnetic separator

Absent Upton left for eastern home at 6.20.

Thursday Sept. 2. 80

Fibre. A consignment of about 20 kinds of fibrous products from Florida was received from Seguin some of the bamboo inferior in appearance was taken to factory for trial

Magnets. The Magnet in which four or five consecutive successive armatures were burned out, was to day unwound and prepared for rewinding. The suggestion at the time, that there might or must be some defect in the magnet that was the cause of destroying so many armatures, made by a non collegiate was promptly set down on, as presumptious. but now after a couple weeks have passed the magnet is discovered to have a cross with its base and that rewinding is necessary. Aug 23.

Lamp Holder. John Ott completed one of the Lamp holders devised by Mr. Batchelor and sketched in Book No. 165 page 99. The thumb

screw or circuit completer in this case, admits of turning one way only and the contact is made by the pin connected to the thumb piece, which by a spring is thrown in against a metallic ring fitted to inside of socket. a tooth on the thumb piece drops into a notch in the sleeve of the shaft or pin ~~making~~ thus letting the pin come suddenly in contact with the ring to complete the circuit and the tooth and notch are so formed that on turning the thumb piece can be turned one way only and in so doing the circuit is suddenly and completely broken.

Ground. Another permanent and thorough ground was put in near the Laboratory for experiments in working a ground circuit for lights and motors.

Mercury pumps. The mercury pumps at Factory were started this after noon on the twelve only and every thing found tight and vacuum formed on some of them very quickly but before any were heated the motor suddenly stopped and upon examination the arms or poles of the magnet were both found to be crossed with the base, necessitating replacement with another machine.

Lamp Socket John Ott finished a some-what different Lamp socket, to day in the former one the inside cup or socket was secured in the outer one by a screw on the bottom, in the one to day the inner socket has projecting pin on lower end of inner ~~cup~~ which binds under an single screw thread or incline thus making the contact for one line and holding the inner cup in position

Conductors. A large pole was set up between the shop and laboratory as a support for the laboratory wires and brackets put on the poles leading to the Factory for light wires to be run to there. And Mills running the wires and connecting the machines in the dynamo Station.

Insulation. Francis tested about 1000 feet of Kerite wire in water, and found it one million ohms, about same length of heavy braided insulated wire gave about 36000 ohms insul.

Fibre Moulds. The moulds made by Dean which have been in use several days at the Factory having become partially clogged with dirt mostly from rubbing the fingers over them, were brought up to be cleaned.

Visitors. The electrician of American District Tel. Co. with friend in chg of McKenzie

Papers. Herald to day contains another communication from Paget Higgs, replying to Sawyer on electric motors.

Motor. Dynamo taken from Station to the Factory for use in running the pumps. After wires were connected and before the plug was put in the current crossed in some way (through the wood of switch of plug board probably through the oily portions, some part of it having been accidentally saturated with oil.)

Lamp Stands. Duncan is making a great number of common plain lamp stand holders for testing etc. A saw cut is made down through opposite sides of the socket through which the wires may extend and be secured under springs which are connected to the circuit. The lamps may be very quickly placed or removed without any previous preparation. After which they may be placed in the commercial socket.

Cable insulation. The experiments on the insulation for cable conductors are being continued with Muslin, rubber cloth, tars gums &c. the full particulars of the insulating material and forms of insulation are in Book No. 104 page 73 &c.

Absent. Mott returned to night after an absence of two weeks on vacation.

Mr. Upton still absent with his family.

Work general. Mr. Batchelor on detailed drawings of clamp Machine and Dean and assistants at work on same and on clamp former for Bamboo. Smith remodelling the friction clutch wheel for electric locomotive. Men digging foundations &c. for building and gas works at Lamp Factory and pumps there prepared for starting.

Motors. The dynamo taken to the Factory on Saturday was returned to day having found to be crossed both poles of magnet and also Armature commutator with base. The armature of the one brought up on Saturday was also found to be crossed with the shaft.

Gas Furnace. Three additional Gas Furnaces for carbonizing were delivered at Factory this morning. Now making in all five (all that provisions have been made for) these ready for use. Men also at work there putting in the Consolidated Gas Generator.

Vice. W. S. Andrews is making in pursuance of sketch by Mr. Batchelor a vice for holding and bending and holding the lamp wire for lapping and having clamps put on, the present vice is somewhat different in construction from the one now in use, but not sufficiently advanced to admit of a description.

Call box. during yesterday by request and instructions from McKenzie John Ott made drawing of a call box in which a wheel takes the place of the slide used in the present box. he is to day making the ~~Mott~~ patterns for castings for it. Tracing of the drawing was made by Mott and the original taken by McKenzie.

Fibres - ~~Upson and~~ Another consignment of fibres ~~was received~~ to day from ~~Segredor~~ from Florida.

Visitors Prof. Rowland, Col. Eaton. Johnson.

E.L. Fixtures. Mr Edison made sketches of a number of styles and ways of running and concealing wires on Gas chandeliers some devices being fitted to permit of the use of either. Electric or Gas Light without interference with each other.

Conductors. Wires for lights and carbon testing were run to and into Factory. to have current independent of the power circuit.

Factory addition. Masons commenced laying foundation for the store and packing house supplemental to Lamp Factory. Caleman's House about finished and occupied by him.

Clamping carbons. the ~~moving~~ movable table machine for holding the clamps and introducing the carbon for clamping made by Andrews and described under date Aug 27. was set up and tried to day at Factory by Charlie Hammer, he finds it very convenient and handy.

Dynamos. Forgings of soft iron for the magnet arms or poles and top piece for the large 100 horse power dynamo were recd. Another of the regular dynamos being the third machine, was taken to Factory to replace the one crossed. and to be used as pump motor.

Lamp. Hipple to day called my attention to a lamp he had made using a new style of enlargement on the inner tube and which after sealing together had remained over a day without cracking or checking and which had not been annealed. After heating the inner tube as if for blowing the small bulb or enlargement, he simply pushes the ends toward each other and the heated part is thus made to project all around forming a thick disc on the tube. the globe part is then prepared for the inner tube by slightly thickening up at the point of sealing so that equally thick and ~~equally~~ heavy glass are sealed together and the liability to crack lessened. over cases in which the thin glass is ~~annealed~~ sealed with thicker glass, as in the former way of blowing a small globe on the inner tube thus thinning the glass of inner tube which would be sealed to the thicker glass of the outer globe

Insulation Cable No. 1. Rubber cloth, white, each spiral overlaping about 1/3 width, coated wire with coal tar boiled stiff put on hot = 54 ohms

No. 0. bare wire, No 10 - 100 ft long = 127.

No. 2. Three thicknesses white rubber cloth each coated with boiled coal tar. 51000 ohms fell to 4850 - 3200 - 2630 - 1500 -

No. 3. Two thickness white rubber cloth wound in opposite directions. 77 ohms.

No. 4. Three Muslin each covered with boiled coal tar, 120 ohms.

No. 5. 2 - Muslin each served with hot Linseed oil. 470 ohms 140 ohms 110 ohms.

No 6. Muslin ~~served~~ wound on cable 1 thickness served with paraphine then black rubber cloth. thin Muslin again & paraphine 1200 ohms. 171 - 120. v -

No 7. Three Muslin each served with coal tar treated with quick lime to neutralize acid 120 ohms. v

No. 8. bare wire rubbed with cold paraphine 1 layer black rubber cloth, black rubber cement, then rubber cloth, smoothed down

with black hard paraphine 12 500 ohms
7000 - 130 ohms.

No. 9. Same as No. 8. except rubber cement was replaced with hot paraffine. 9,000 ohms
3500 - 120 - ohms

No. 10. bare wire served with white rubber cement, then white rubber cloth, then compound, No. 3 rubber cloth then rubber cement, then again rubber cloth and rubber cement, dusted with percipitated chalk. 299,000 ohms. 1400.

No. 11. Same as ten except compound No 1 is used instead of compound No 3. 79,000 ohms

No. 12. bare wire wound with Marlin served with compound No. 2 then Muslin soaked in Linseed oil. then Comp'd No. 2. thinned with cotton seed oil, then muslin, then black rubber cloth, then white rubber cement then white rubber cloth 26,000 ohms 1000

No. 13. bare wire wound with Marlin, coiled & boiled in compound No. 3. then covered with rubber cloth. Not yet tested

Compound No. 1. is Asphaltum Pine tar cotton seed oil. No. 2 is rosin pine tar cotton seed oil, No. 3. black pitch, pine tar & cotton seed oil.

The above cables and compounds have been made and tried up to the evening of Sept. 8. by Howell The number and manner of insulating and also the tests of resistance or insulation were furnished by ~~Howell~~ him from a private memorandum book. ~~and~~ the tests by Francis may be found in Book No 137 page 103.

The tests of No. 1. and No. 0. show curious results and speaks badly for insulation or testing. It is rather difficult to reconcile the records with a bare wire testing better than one with an insulation.

Contract made. Copied by request of Mr. Miller, of agreement T.A. Edison with Biederman et al. of Switzerland, giving them exclusive use of Patents relating to Light and Power System for that country for one half of the net profits, and guarantee from any liability or loss.

Pump Motor. The machine taken to Factory yesterday was set running on the pump but after a time suddenly stopped, and on the full current indicated a cross of the armature but no burning or unusual heating. the armature however tested all right with a battery current and the action was rather puzzling. They were led to examine into the cause of the up-stairs machine always giving out and it was discovered that they were using or trying to use a .14 ohm Armature there against a .55 ohm. one down stairs and reasonably supposed that that had caused the difficulty.

Reverser. Mott made Pat. Office drawings of a Lamp arranged with a reverser of his own design, which can be turned only one way and each time that the lamp is turned on the current is reversed through the carbon, or sent contrary to the way it had just previously been passing through.

Papers. To days "Sun" publishes an article discriptive of the progress made by Mr Edison ~~toward~~ in the general introduction of his Light and power system and steps made for manufacturing the Lamp and of the perfection to which he has worked the system. but injudiciously fixes date of Oct. 1. for the practical demonstration to be made here.

Station conductors. Messrs Clarke and Upton discussing the merits ~~and~~ sketching the different methods and ways of running feeding conductors from Stations to the supply lines, to determine the most economical way of maintaining an equal pressure or electro motive force at all the Lamps of the system. Sketches dated by self. Sept. 9. 1880.

Pump Motor. Another machine with a .55 ohmic armature was set up at Factory and run ~~for~~ a part of the afternoon supplying the carb. testers and one tier (about forty) vacuum pumps, and being of the same resistance of the blower motor no perceptable fall

in speed or power was observed in the blower machine, when the other was put in the circuit.

Cutting Moulds. Dean finished up another fiber cutting mould with an improvement by the addition of a knife on each end worked by a small lever and used to cut off the ends instead of using a fine hand saw for that purpose as has heretofore been done. The work may be done much quicker with this arrangement and do away with the saw dust which was likely to get in the clamp and prevent their proper working.

Absent. Mr. Upton returned to day having been with his family since Aug. 28. Several of the men are absent to day at New Brunswick on subpoena before the Grand Jury in case of Cornish.

Factory. Heavy beam secured on the roof to which to attach hoisting apparatus for handling the motor.

Pump Motor. The pump motor at Factory is working very satisfactorily to day and twenty seven good carbons were obtained out of thirty eight tested. No lamps yet put on. the chain of power pump caught several times stopping it suddenly and will have to be taken apart and remedied if possible.

Fixtures. Johnson procured a six light chandelier, on which to experiment in artistically fitting with connections, wires &c. for substituting the electric lamp and to arrange for use of both or either without as little change or disfiguring as possible.

Patents. Made copy for English Patent Specifications No. 15. on Subject of Dynamo as generators and motors for translating power into electricity and retranslating into power

Visitor: [illegible]

 Saturday Sept. 11. 80

Papers. "Truth" to day publishes the report of their reporter who was here yesterday and gives Mr. Edison the credit of employing two men and accomplishing nothing.

Factory. Power pump taken apart and brought to the Shop to alter so as to prevent the chain from catching. The new Gas-Machine was floated from its place in the pit in consequence of water running in during the rain of the last couple days; will have to be taken out and the pit pumped and again dug out. Van Cleve to day put up sheet iron hoods over each carbonizing furnace to conduct off the heat and gas.

Large Dynamo. Mr. Clarke finished the details and drawings for the Large armature, and the heavy castings for bases of magnets were received.

Sept. 11.

P.O. Drawing. Mott finished the Patent Office drawing for Dynamo, devised and described by Rowland in 1869; in which the polar extensions approach the armature from opposite sides and the wire only of the armature made to revolve, the iron core remaining stationary or nearly so.

Work General of past week. Mr. Batchelor making efforts to get the Factory started, Messrs Edison, Upton and Hammer at work on conductors for central station and plans for laying them. John Ott making McKenzie call boxes for Pond indicator. Dean working several men on Fibre cutting moulds and on clamp machine. Carpenters fitting old glass house for Draughting room, other carpenters at work on preliminary work of Supplemental Factory building. Johnson, commenced on Chandeliers.

Monday Sept 13. 80

Large planer. A large Providence Planer delivered at Machine Shop to day.

Power Mercury Pump. Yesterday Cunningham and Smith prepared the mercury pump to obviate the catching of the chain, and it was put together today and has been running very satisfactorly.

Ore Milling. The rake Machine for washing auriferous ores &c. was finished by Max Force, and tried to day. but did not work up to expectations. Mr. Edison sketched another device to be tried on page 7 Book No. 126. on a swing or rocker principle.

Absent Mr. Clarke in Phila. to see Porter, Allen, Engine progress.

English Patents. Mr. Wilber getting up and keeping me at work on copies of European patents on Light etc.

Tuesday Sept. 14

Patents. Made copy of Specifications for English Patent, on Feeding conductor system; 12 pages and commenced copy of English Complete No. 4. on Lamps, carbons and Means & Methods for manufacturing the same, compiled from American cases Nos. 215, 229, 233, 210, 227, 220, 228, 216 239, 219, 230 & 240.

Factory. Gas Machine taken out to pump and clean out the pit for resetting. Power Pump run till nearly noon and then again commenced catching and suddenly stopping, believe it will be necessary to again take it apart. The testers with larger contractions were found to break by the weight & fall of the mercury, and a medium will have to be determined at which the pumps will stand and do the most effective work.

 Sept. 14. 80

Lamp socket. Johnson sketched a new socket which is designated as "Boss socket" in Book No. 153 page 18th which is now being made by one of the new men in Shop.

Visitors. Maj Eaton here part of forenoon

Elec Dynamometer. Castings were received to day said to be for Electric Dynamometer.

Wednesday Sept 15. 80

Lamps. At factory twenty five Lamps were put on the pumps, and Nos. 3. 13. 17. 18. 25. gotten off the others were about ready to be sealed off when the power pump caught and stopped. and the vacuum was lost. The pump was again taken apart in the afternoon. and taken to the shop to have alterations made to prevent if possible the catching.

Large Dynamo. Five castings for the large Dynamo were recd to day and Logan turning and preparing the magnet cores for the wire and base and top pieces.

Absent & Visitors Mr. Kruesi went to New Brunswick this P.M.

Manager of British Pat Office Museum with his wife here during afternoon and evening. Col Stuart Wortley

 ~~Thursday~~ Sept 16. 80.

Factory. Power mercury pump, had some alterations made on it this morning and put together and it running this afternoon very successfully.

Planer. The large planer was geared up and run tonight. A new chain and pulley lifting gear has was used for use at the planer.

Large Armature. Smith today cut out of wood the facsimile of the copper strips that are intended to be used on the large armature.

Friday Sept 17. 80.

Patents. furnished copy of English Patent No. 12. which includes American Nos 210, 215. 216, 219, 220, 227, 228, 229, 230, 233, 239. 240. 241. covering 58 pages and making 64 claims on Lamp & carbons and means and methods of manufacturing the same which was given to Hughes to carry to Sewell,

Roller bearing. Gentleman here this morning with models of patent roller bearings. did not learn his name or any particulars of the device.

Planer. The top pieces for the magnets of new Large Dynamo were put on the new planer and started to dress them down. the machine run with too much noise and it was stopped and the driving pulleys taken off to try to remedy the objection.

Sept 17. 80.

Factory. Power pump worked well till near night when it again caught and stopped. confirming the belief that it is unreliable, and Mr. Batchelor now proposes it be taken out and a screw pipe or worm be substituted.

Call box. Ott finished a couple of the call boxes for Ponds Indicator or telephone exchange in which cylinders are used instead of the flat slides as in the previous one. We tried to night they worked a sounder very accurately and well.

Insulation. Howell finished cable last night which was put in a barrel of water (soft) and this morning the bridge indicated no leakage by its inability to measure it, indicating it to have over one million ohms. See Saturday Sept 18. for the composition and manner of applying.

Work general past week. Experiments continued in insulating compounds. Mr. Batchelor working at Power mercury pump at Factory, but unsuccessful in getting it to work reliably. Mr. Upton at work on Station conductors. Smith on wooden facsimile of Large Armature commutator connections. Logan on casting of Large Dynamo. Dean and assistants on Clamp Machine and fibre formers.

Insulation. See Sept. 8. No. 14. 7 strands No. 10 wire bound together with Marlin.

No. 15. 3 Layers Muslin and refuse comp?

No 16. 3 coverings white rubber cloth and boiled pine tar.

No 17. Muslin, compound No. 4. two layers then Muslin and oxidized Linseed oil.

 Sept 18.

No. 18. 3 thickness muslin & Pine tar.

No. 19. 3 layers Rubber cloth with two coatings of Compound No. 7. none on outside.

No 20. Same with muslin instead of Rubber cloth, and two coatings of compound No. 7.

Compounds tried No. 1. Asphaltum Pine tar & cotton seed oil.

No. 2. Rosin Pine tar, & cotton seed oil,

No. 3. Black Pitch Pine tar & cotton seed oil

No 4 Pine tar, Venice Turpentine, & Rubber Cement

No. 5. Oxidized Linseed oil, Asphaltum, Rubber Cement

No. 6. Oxid. Linseed oil, Camphor, & Sulphur

No. 7. Oxid. Linseed oil, Pine tar, Asphaltum and Paraffine.

These data are taken from small book of Howells.

The comp'd No. 7. was that used on the cable tested yesterday and has been adopted as the best for the purpose of the cables here

Wednesday Sept 22d 80

Absent. Mott absent since Saturday morning. Ret'd. this morning. Last night. Learn that Mr. Kruesi was in Philada yesterday to see about and order a screw pump for factory and Mr. Clarke in New York to see high speed engine on exhibition at the American Institute Fair.

Tar Boiler. received during my absence a portable furnace (or Stove) and boiler or Kettle for boiling and preparing the insulating composition for the lamp lines. also received

Fixtures. A lot of chandeliers and globes of all styles and colors, to experiment on interior lines and decorations, and different styles of fitting them with the electric Lamp.

Vacuum Pumps. The long rubber leading from the pumps to the drain or bottom iron pipes of power pump were taken off today and in place of the nipples in the pipe, were put long pieces of tube extending nearly to vacuum tube, and mercury led into them by shorter rubber tube.

Gas Data. Russell brought in one book the results of his canvass of four blocks for data on Gas, cost, power etc. and matters important to know for the before establishing a Station in the City.

Pat Office drawings. Mott finished Pat Office drawings of a balance meter arranged to change course of current when the loss from one plate and accumulation on the other is sufficient to

turn the balance or scale, and which also at same time record each vibration of the scale.

Conductors. Men today commenced preparing in larger quantities the insulation used on cable & mentioned on Friday and more fully described under date of Saturday, for insulating the light lines of Street Lamps etc.

Addition. Men commenced small addition for shelter and protection to head of the large Lathe when in use.

Visitors. Col. Armitage Gas Engineer who would not be convinced that the size of a piston rod designed for a certain amount of work per minute or second, did not depend on the speed. Nor that a a rod which acted 10 times a second to accomplish a certain work in a second could be smaller than one which did the entire work in one stroke in a second

Thursday Sept 23rd 1880

Conductors. Men commenced uncovering again (third time) the conductor trenches of Street Lamps. others preparing muslin with compound of Oxidized Linseed oil, Pine tar, Asphaltum and Paraffine (No. 7) with which to rewind the cables.

Insulation Herrig is continuing experiments on an insulation for in doors and trying for a substitute for Kerite.

Absent. Messrs Edison, Upton and Francis went to New York at 3 30 I hear to visit some Gas works. Mr. Batchelor also absent part of the day.

Visitors. Mr. Whitney of the Firm that cut gear for elec. locomotive. Also Board of Indicator.

Arm tool holder. Mr. Kruesi sketched an arm tool holder for large planer

Friday Sept. 24. 80.

Conductors. Fifteen men and boys were to day set at work in insulating the Street Lamp conductors, by winding with two thicknesses of Muslin served with composition of Paraffine, tar, Linseed oil and Asphaltum. And Martin Force changing Laboratory wires to the loft and on outside.

Screw pump. Bergmann was here and took with him the drawings of Screw pump from which to make the patterns.

Absent. Messrs Edison, Upton and Francis returned from New York late in afternoon. In their measurements of Gas jets they found the ordinary burner, at usual burning, to give about 7 to 7½ candles but from one burner in Bergmann's got 27 candle power. Notes measurements in Book No. 160 page 5 etc.

 Saturday Sept. 25 80

Lamps Geo. Hill put ten lamps on the pumps at the Factory this morning and got good vacuum, commenced sealing off and after getting off three the pump stopped "short" and vacuum in the others was lost. on examination the chain of the pump was found to be broken.

Glass. Four boxes of glass tubing was rec'd at Factory this morning.

Elec Pen Press. received at Laboratory a Press for reproducing the work of the electric Pen. The Patentee here in the afternoon and received an order from Mr. Edison for one of the presses.

Absent. Mr. Kruesi went to Philada. with pattern for the screw mercury pump and ordered some of Morris & Tasker. Also saw Porter Allen engine, thinks it will be finished in about four weeks.

Visitors. One of the examiners from the Patent Office. Friend of Mr. Wilber.

Work general past week. Carpenters at work on building supplemental to Lamp Factory. Gang commenced third laying of Street Lamp conductors insulating with composition. Large planer running on castings etc of Large Dynamo. John Ott finished three call boxes for Load indicator, and continued work on wooden fac simile of commutator for Large Armature. Dean on Clamp machine and Bamboo clamps formers.

Large Planer. during yesterday Masons put brick foundation supports under the Large Planer, and removed the iron legs.

Manufactured Lamps. Up to present date twenty seven one half good lamps is the proportion out of 100 fibers. Are now getting out fibers at rate of 550 inspected fibers per day.

Pump. repaired and again running very successfully all day, and eighteen lamps sealed off.

Carbon Formers. Forty three carbon formers on nickel moulds were sent to Factory to day, making enough so have a three to fill and keep three flasks running. Neal Van Cleve says he can now get out about 100 carbons per day.

Absent. H. P. Mott went to house about five o'clock and to bed, sick with chills or malaria

Pumps. The pumps at Factory were started this morning with twenty two lamps on. worked well all day and good success had in getting off lamps. 30 of which were sent up here for testing.

Contraction. Mr. Batchelor making measurements and observations on the pumps in relation to the contraction, to determine the proper size of tubing and proportion between contraction and tube that will give the best results in obtaining vacuum and the least liability to break by the fall or beat of the mercury. Book 106 pg. 3 &c.

Carbon Clamper. Andrews is making an instrument for holding and clamping carbons, similar to one described Aug 27. except that the table in the present machine is so arranged by an incline of the cogged strip that it is lowered from the carbon at same time it is removed back from the clamps.

Office. Cornish at work in the down stairs office removing a portion of the partition and placing it lengthw of the room to give more room in the office part at a sacrifice of the unused room in the front of office

Flat Sealing. Holzer to day showed a new idea in sealing the wires through the inner tube of lamps. and was directed by Mr. Edison to make 100 lamps after the new style. after the wires are put through and secured in the inner tube in the usual manner, the tube is well heated all over and compressed again the wires making a long seal, the glass being solid the length of the small tube say 3/8 of an inch. by compression.

Heat Exp with copper strips } Some cloths covered copper pieces about 1/2 inches in diameter were secured in the core of the armature of

the large dynamo in dynamo station. and was propelled by one of the regular machines connected up and run as a motor. up to 240 Revolutions and running one half hour in strong field. No heat was generated the third test at 300 Rev. thirty minutes was 7° heat, and at fourth test 300 Revolutions and running one hour the air temperature was 76° and temperature of the copper strip 88°. Book No. 176. page 85 &c.

Visitor, Bergman with a telephone also a Londoner, friend of Johnson and Atachee of Edison telephone Co.

Elec Pen Press. The press sent here on Saturday and shown off by the patentee, were reshipped to him to day.

Papers. The New York "Sun" of to day states that a New Brush Electric Light Company has been organized in ~~New York~~ among for New York City with office at 860 Broadway, with intention of establishing a Station in neighborhood of Union Square, and a claim to maintain forty lamps with current from one machine.

Call boxes. McKenzie completed and put up two call boxes connected with telephones and working through the drops, both worked admirably.

Organ. The maker of the Laboratory organ is here to day and giving the instrument a thorough overhauling and putting it in good repair.

Factory Lamps. Frances to day commenced testing the factory lamps, at 48 to 50 candles 18 of which were tested to day but not yet figured out. Book 119. pages 5 to 39.

Heat of copper rods. Further experiments were made to day on heat of copper rods secured on core of armature and revolved in a strong magnetic field. ~~Second~~ Book 116 page 89

Engine. The Engine was stopped to night in consequence of scarcity of water and will probably not run evenings until after a rain storm or a better supply of water is in some way obtained.

Combination Gas works all in position connected up and ready for the oil, the black apparatus was trouble some to day and Holzer took it apart and made some alterations so that later it was working some better.

Decorations. Boys putting different colored double well insulated wire through small thin lead pipes or tubing for use on the chandeliers and any points where protection or concealment of the wire is desirable.

Arm tool holder, an arm extending about fifteen inches out from the usual position of the tool holder on the big ~~lathe~~ planer was fitted up and prepared for securing to the head block for use on the large planer as a tool holder.

Visitors Col. Eaton.

Tubing Some tubing received for experimenting on the proper size and proportion between the contraction and the tube, to give the best results in exhausting also to determine the more economical size or thickness of tubing that will best resist, without breaking, the fall or pound of the mercury.

Visitors Maj Eaton and a party of friends were shown through the factory by Mr. Edison. A reporter of world also here in after noon.

Absent Mr. Upton went east in the afternoon.

Angle plate Andrews is making a pattern for an Angle plate for the Large planer.

Carbon formers New foreign man, next to Andrews to day commenced work on sixty additional carbon formers or moulds same as those now in use.

Carbon Clampers Andrews commenced work on another carbon clamper, or vice for holding the clamper while the carbons are inserted.

 Saturday Oct 2 80

Papers, "World" to day publishes an article, attributing the delay in ~~not~~ making a demonstration here to the fact that the Porter Allen Engine does not come to time.

Absent, Edison Batchelor and Johnson went to New York at 6 30.

Mott went home sick with the chills.

Work General for past week, Logan, Some of shop men working on Large Dynamo, Dean and assistants on Bamboo lamps And on clamp machine. Painters finishing up new drawing office, Factory turning out quite a number of Lamps And Francis testing them. Upton and Hammer on Station conductors. Mr. Batchelor at Factory. Johnson at work on chandeliers.

Wednesday Oct 6 80

Absent C. P. Mott returned this morning after absence at home since Saturday. Mr. Upton also retd to day from visit home.

Chandeliers On Sunday Johnson put up the blocks and tube cased wires for the Chandeliers up stairs in the Laboratory.

Visitors. On Monday afternoon Pullman of the Parlor Car Co. was here to see about an electric motor for operating a transverse table for cars for which he has a patent but has operated it by man power.

Gasolene Vapor, Mr. Edison is to day making some further experiments with carbons in vapor of coal oil, the inside of the chamber was filled with floting carbon and the loop augmented some. ~~some further operations will be~~ The carbon will be subjected to some further operation to complete the experiment

Combination Gas. Oil was placed in the combination gas machine this morning and it is to day supplying ~~the gas for the factory~~ plenty good gas for all the demands of the factory.

Pump. Men worked all night and till ten o'clock this morning on the Power pump and got it again ready for use but it has not been running during the day.

Meter. Andrews finished a carefully made balance meter which was taken into the Laboratory for use in connection with his meter experiments & work.

Illumination. About one hundred lamps were lit up stairs in the Laboratory to night and kept part of the time at forty or fifty candles. They were run

all night and at four o'clock in the morning about two dozen were left and unbroken.

Engine. Engineer "California" quit to day to seek his fortune in a Patent and Alfred Swanson was given his place at running the engine.

Visitors. Man here offering lands for Lamp Factory.

Segredor returned from Florida on Tuesday

Thursday Oct. 7.

Tap box. Andrus finished pattern for castings of Tap box or box to be used at all points where the Main conductors will be tapped with other wires for house or other purposes.

Chandelier. The little frenchman is making a chandelier bracket after sketch and design by Johnson. Book No. 153 page 44 &c.

Conductors. The line leading from Edison's line past his barn and to Street near the gulley was wound and covered in the soil without boxing. And tests 3300 ohms.

Insulating Machine. Mr. Hornig is devising and making drawings of a machine for filling piping with insulating material after the conductors have been placed therein in position.

Absent. Mr. [illegible] [illegible] to Phila. [illegible]

Friday Oct. 8. 1880.

Patent. Made another copy of English Patent No. 14. Subject of feeding into extra separate conductors to equalize and maintain uniform pressure on Lamp or translating circuits. 11 pages.

Interference. Edison vs Blake. Subject telephones evidence being taken here to-day.

Induy Meter. Bergmann here and brought the clock work and mechanical part of the balance meter. The box has three dials connected with the clock work which is worked or moved by the action of the current when the copper has been transferred from one plate to the other sufficient to cause the balance to move sufficiently to make an electrical connection by the pointer, which in turn moves the clockwork and dials pointer and at same time changes the direction of the current through the meter cup and recarries the copper until the balance again acts and so on during the useful lifetime of the solution and copper.

Oct: 8:

Chandeliers. Mart Force assisting Johnson in putting up chandeliers and brackets of various designs fitted with wires in lead tubing. ~~up stairs in the Laboratory~~

Lamps. A number of Lamps were sent up from the factory to day in which the sealing of the wire was effected by first sealing a piece of fine drawn tubing about one half an inch long to the wire and then sealing the glass to the glass of inner bulb, allowing the glass on the wire to extend partly above and partly below the plane of the small bulb thus securing a longer seal with less liability of a check extending through sufficiently to admit air

Rubber cloth. Two packages of rubber cloth in strips recd for winding cables etc.

Saturday Oct. 9. 80

Interference. Edison vs Blake or Dolbear interference on telephones evidence continued to day

Gas Canvass. Mr. Russell brought to day the third book of canvass on gas power etc. so far has met with excellent results and obtained the desired information in all cases but one, that of a gas stock holder.

Call box. McKenzie to day prides himself on the entire completion of the call box and system in all its details, after nine weeks labor.

Work. Usual for past week. Factory has been turning out and Francis testing a considerable number of Lamps. Work progressing nicely on the large dynamo. Dean and assistants still on clamp machine and fiber cutting clamps. Gang on insulating the Street conductors. Carpenters on inside work of Factory supplemental building. Man. (Moore) left for China and Japan

Conductors. Another pair wire for lighting up lamps in the lamp case were run by Mark Force from Station to the Laboratory.

Lamp. Holzer suggests a lamp what might be called pear shaped and to be received in that shape from the glass factory. As being cheaper and fully as nice a design as the shape now used. The bulb would be thicker and better for sealing in the inner tube & carbon.

Preparations are being made for lighting and testing about 100 of the factory lamps tonight.

Rubber lined pipe. A lot of three inch rubber lined Iron pipe was received to day for experiments of insulating conductors therein.

Visitors. Frank McLaughlin here to day having arrived from California yesterday.

Building. Carpenters to day commenced work on a new building for black smith shop etc. 22 by 24 feet adjoining the old shop and carbon house.

Printing glass. A 3/8 in glass french plate two by three feet for use on the apparatus for blue printing process was received and a man grinding off the edges.

Commutator. The casting for the commutator base or core for the large dynamo was received and Logan turning it up in the large lathe.

Lamps. 98 lamps of the second hundred from the lamp factory were started about three o'clock this morning burning at an estimate of forty eight candles and about twenty remained whole and burning up to six o'clock in the evening when the current was turned off and to have the remaining lamps retested for vacuum and resistance. No 171+173

Photometer. Freeman finished a photometer apparatus for Mr. Batchelor to be used in Supplemental building at Lamp Factory.

Pump. Again to day suddenly stopped with twenty two lamps on vacuum pumps heated and nearly ready to seal off—several were destroyed and vacuum lost in all.

Gas. By mistake in putting oil in the wrong pipe of Combination Gas machine it has been working badly so that the Clarke machine was again filled and has been supplying the gas for the Factory to day.

Lamp tests. The lamps that remained unbroken at six o'clock last evening about twenty in number were brought down stairs to be tested by Francis, results not figured out, no comparison yet made and memory does not serve him to tell whether the resistance and economy is higher or lower, since their previous burnings but

Water. The water for engine is very low and running nights discontinued except on extra occasions.

Visitors. Gamble, General Supt. of Western Union Telegraph Co. San Francisco and E. W. Andrews President of American District Tel. Co. New York with a party of others.

Pear Shaped Lamp, one of the lamps with pear shaped globe was made by Holzer and sent to Laboratory this evening was burned awhile, generally conceded to be a better and nicer style than the oblong ones now generally made.

 Thursday Oct. 14

Water. Man digging trench for pipe leading into the pond about two feet deeper to more completely drain it.

Pear Shaped Globe. One barrel containing one gross of pear shaped globes for latest style of lamp was rec'd at Factory to day.

Pump. Mr. Edison trying experiment of using water in regular vacuum pump to see whether it would act in producing vacuum, N.G. total failure.

Rotary Engine. New Rotary Engine Wests patent Manufactured by Colts Arms Co. was tried to night, the engine of six horse power and calculated to make Seven hundred revolutions. Run up to 800 Rev. machine empty and with low resistance lamp & six ohms resistance reduced the Revolutions to 680.

Oct. 14

Gas Com. Mchn. Holzer refilled the Combination Gas Machine properly and it is now working very nicely whereas before the weight run down in 2 or 3 hours it now runs 24 and over.

Visitors. Mr. Baily — Esq Wood.

Factory. Carpenters putting up partitions between the different departments down stairs in the factory.

Papers. The present issue of the "Scientific American" of date Oct. 23. 80, publishes [illegible] and descriptions of Maxim's incandescent Lamp. Dynamo Machine and current regulator, claiming the Dynamo to be capable of heating to incandescence 80 feet of No. 9 iron wire and to have maintained 64 lamps at 30 candle power each, and as estimated by Maxim to be capable of maintaining 200 of his Lamps. The regulator acts so accurately that in removing one by one of the Lamps until but one remained, the regulator so varied the current to suit the conditions that no perceptible difference could be

seen in the illuminating power of the last lamp or a single lamp at any time.

Patent on incandescent lamp granted Aug. 10. 1880. Process of Manufacturing carbons July 20. 80 Dynamo Machine June 8. 80 regulator June 8. 80 and Process for charging the lamp with gasoline vapor Aug. 10. 1880.

Interests identical with U. S. Elec Light Co.

Lamp case. A show case in first floor of Laboratory was filled with lamps ~~and let~~ which were let at sixteen candles and allowed to burn all the time engine was running. The heat on the shelves and wood work was very slight.

Water. Very Low. discussing, laying pipes and pumping from Edisons pond or brook down in gulley

 Saturday Oct. 16.

Gas carbons. Francis arranged an apparatus for heating carbons in gas or vapor of chloroform, ether etc.

Canvass. Mr. Russell to day sent out the fourth ~~book~~ canvass book filled with data on gas burners etc.

Pumps. The double tier of vacuum pumps supplied by power pump were taken down and the supports set out from each other two inches on a side and the upper one lowered about six inches.

Visitors } A New York Public Official said
About } to be a member of board of Aldermen

Mr. Upton ~~spent~~ at 12 o'clock to Philada.

Work general. Testing lamps by the quantity. Men on Large Dynamo. Gang of about twelve on Street conductors, Dean and assistants on Clamp Machine and clamps for cutting bamboo. Rotary engine received & partially tried.

Monday Oct. 18

Belt Pump. A power pump to run by belt was received to day probably to be used for pumping water from Pond or brook and to be operated by electro-motor.

Heater. A heater was also received for heating water for the boilers.

Meter. John Ott is changing the mechanical part of the balance meter so that when the rod or pointer connected with the balance shaft contacts on the different sides it reverses the current through the a pair of magnets causing a rod or arm passing between them to be repulsed or attracted and each movement of the arm by points on the extreme end propels a notched wheel which in turn imparts the motion to the mechanism of the box and to the hands of the dials thus registering every vibration of the balance

Draughting Room. the building for the draughtsmen was finished up to-day and they moving in.

Visitors Bergmann here and shown a resistance apparatus, probably for the purpose of Drawing some of them.

Absent. Edison at New York all day. Insull at Philada and Upton at Princeton.

Brush Lamp. A Brush lamp was brought by Mr. Upton and burned awhile this morning put one ohm resistance in to relieve the machine of so near a short circuit.

Pump. Mr. Batchelor experimenting on pumps and continued at it nearly all night amongst the most successful experiments was one of sealing off the fall tube about six inches below the gauge connecting tube and passing the mercury through the short connecting tube and down the gauge tube, the contraction having been made smaller. on this pump a very good vacuum was obtained in about fifteen minutes by running about one and a half pounds of mercury per minute

Lamp. One dozen inner-parts of lamps order with three wires sealed through the glass. probably to use two carbons

Chloroform Vapor. Francis heated some carbons in vapor of Chloroform and also of Bi Sulphide. the latter coated a little but the chloroform coated very nicely and evenly. carbons not yet put in lamps.

Visitors. Mr. Inman of Inman line of Steamers. was well pleased with our and talks as if there was no question about their adopting the light on their new Steamers.

Absent. Maj. Mc Laughlin bade good bye for his return to California to night.

C. P. Mott absent in New Brunswick all day on abstract for Johnson, Book 136 page 85 etc.

Steam pipes. A couple loads of steam pipes delivered at Lamp Factory for heating purposes.

Chlorine Gas. Francis trying some experiments on heating carbons in chlorine gas but unsuccessful in getting out any good specimens.

Resistance Box. finished yesterday and tested all right. It is composed of a lot of resistance spools secured to under side of board, on small table on top is a crank which being turned from point to point throws in or out a fraction or a number of ohms as the case may be. at each full revolution of the crank it enters a notch in a wheel and turns it sufficiently to throw in or out several ohms. Thus making so to speak a double resistance box.

Mica. A number of large sheets of mica received and by Cunningham secured on the core of the large commutator to insulate the stripe from the core.

Wood shrinkage. Johnson is boiling some spools of different woods in Alcohol and rosin to determine the kind to use for sockets, subject to the least change or liability to wharp or check.

Visitors Fabri and a party of friends

Gasoline vapor. Francis secured a piece of gas pipe in one of the old nickel moulds, and introduced gasoline vapor after being well charged the moulds was placed in the furnace several of the first tests were unsuccessful from having been kept in to long and heated too much giving the carbons a wolley appearance. Some of the tests later in day when the mould was brought only to a red heat in the furnace the carbons came out coated more smoothly.

Brush Lamp. Mr. Upton making some experiments with lenses on the Brush arc Lamp to concentrate the heat on the clamps of the Edison lamp during the process of obtaining vacuum to assist in expelling the air from the clamps by means of the heat.

Pumps. Mr. Batchelor continuing experiments on pumps and sketch of one dispensing with the fall tube given Mott for Patent Office drawing

Oct. 21. 80

Ideas sketched. Mr. Edison sketched two modes of attaching lamps to pumps and drying devices one for heating in a chamber connected to the pump a large piece of carbon to incandescence thus expelling the moisture by heat, the other device being a chemical ... similarly connected to pump. Two sketches of armatures, similar to the one the details of which were worked out by Clarke and one subject unknown dated and signed by himself, the others dated and witnessed by C.P. Mott.

Disc Engine. Agent here and worked nearly half an hour to get it started found to be full of water in consequence of stopage in small pipe for drawing off the water.

Left. G. K. Boehm left, his position not consistant with his honor and ...

Friday Oct. 22-80

Arc Lamp. As one result of the experiments with the Bush Arc Lamp Mr Upton and Martin Force are laid off to day with painfully sore eyes.

Meter. Current to two lamps is being passed through the balance meter connected to the box of recording dials made by Ott. Oct. 18, 1880.

Chlorine Gas. Experiments continued by Francis. No very favorable results. Book 104 page 175.

Water. slight rain to day added a little water to the cistern and the power was run till twelve o'clock for Mr B. to continue his experiments on the pumps the best results so far have been with the fall tube cut off about six inches below the cross tube and flowing the mercury down the gauge tube to which is attached as shown on ...

 Oct 22.

Absent. Mr. Kruesi in New York all day. Mr. Upton gone home.

Visitors. Telephone man of Boston. Vail Building. Black Smith Shop finished

Statement Made copy of Mr. Edison's in Interference Sawyer and Man vs Edison in which he states that he experimented with paper carbons in 1876 and applied to electric lamp in 1878.

Canvass. Mr. Russell here to day and brought the 5th book of gas & power canvass.

Patent Copy. Made copy of Provisional and Final English application for Patent on Automatic signalling with Magneto electric machines for Mr. Edison & Johnson.

Armature. Mr. Edison made sketch of a new form of armature composed of discs and spaces of cross plates or pieces which was given to Mott from which to make Patent Office drawings.

Visitors. Burbank the electrician and the agent for Root Boiler.

Work general for past week. Carpenters finished Black smith Shop. Dean made a start on the large armature. Mr. Batchelor experimenting on pumps. Gang on insulating cables. Colm Ott at work on meter. Draughtsmen all in new room.

Engine. during yesterday Alfred, gave the engines an overhauling and repacked both of them.

Pumps. Eighteen of the new form of pumps with gauge tube turned into the fall tube with drying vacuum and spark gauge tube attached are up and working very nicely.

Drying furnace. the upper portion of a cylinder stove with perforated partition secured therein for holding the lamps [illegible] which it is intended to burn gas jets to keep the moisture out of the lamps before being placed on the pumps was set up in the factory to day.

Sketches. In Book No. 60. pages 1 to 5. Mr Edison to day made sketches of several forms of lamps: shapes and kinds of carbons and means for heating them on the pump to exclude the air & moisture.

Carbon. Mr Edison and Francis are to day experimenting on building up and making carbons more homogeneous paper was soaked in tar and placed in mould. Napthaline gas was passed through the mould while in the furnace the paper carbonized hard, smooth, very homogeneous with a ring like a piece of steel. A lamp was then put on a pump and Napthaline vessel connected with gauge tube, after passing the mercury for a time to remove a portion of the air and permit the gas to replace it the loop was carefully heated by the current, but at first gave every appearance of oxidization and was exceedingly irregular. after running the pump for a few minutes longer, the current was again applied and the loop gradually warmed up and soon gave appearance of being entirely even. the inside of the globe was however due could

the carbon was removed by Mr. Edison and found to be nicely coated and of good appearance under the Microscope and more tough or tenacious than the ordinary carbons. Several trials were then made of passing Napthaline through the moved, in the furnace, in which was placed Bamboo strips &c. but with indiferent and varying results.

Water. Lumber taken in the gulley and shelter erected for dynamo motor and pump for pumping water for the engine.

Visitors. Bailey of ~~Boston and Baty~~ Maj. Eaton and two gents on business ~~in evening~~.

Heat at Factory. Pipe fitters are putting in steam heating pipes at Factory.

Carbons. Mr. Edison and Francis continuing experiments in coating carbons in Napthaline gas. with fair results and ~~good~~ success except one explosion which they had prepared for, by placing the lamp in a box. See notes in Book No. 104 pages 178 &c.

Reflectors. two packages from the United States Reflector Co. opened and in early evening some interesting trials made on the electric lamp with them and with some of them very fine results were obtained in reflecting and concentrating the light.

Absent. Mr. Batchelor and Steuss absent all day at Philada. report that the pump is well underway and a promise that it

 Oct 26

will be shipped on Wednesday Nov 3. Not so encouraging reports from the Engine but will have the bed plate in time to facilitate matters here and obviate any delay on the dynamo part.

Switch board. Mr McKenzie informs me that as telephone switch boards are at present constructed normally all lines are plugged on ground bar, necessitating ground plugs to be withdrawn from both lines and being inserted in the blank bar and that he has to day devised and sketched means whereby this may be accomplished by the withdrawal and insertion of but one plug by means of extra connections on the back of the board.

Wednesday Oct 27. 80

Gas Mould. Mr. Andrews finished a nickel frame devised by Mr Batchelor for placing inside the large nickel moulds. the frame has a perforated bottom, on which is a light open frame and the longer cross pieces on top slightly notched each one capable of holding ten carbons or loops. A short piece of gas pipe is secured in the bottom of the mould through which vaporized gas may be introduced in to the mould and pass through the perforated bottom of the frame and being there diffused and passed evenly around the loops after which it escapes through an aperture in the top of the flask, the object being to pass gas or vapor of any kind through the mould during carbonization or by reheating ~~after~~ the loops in the above described apparatus ~~after the~~ with gas or vapor passing through, after the primary carbonization

 Oct. 27. 80

Armature. Dean commenced laying out the heads of the Armature on the cast iron plates prepared and for use therein.

Lamp tests. Francis tested 40 lamps that were not sealed off the pumps until no spark could be had in the spark gauge of the pumps with a 3/8" coil.

Conductors lines were run from Station to draughting building for light.

Factory. The chain pump was run to-day for the carbon tester and about 25 carbons tested.

Sequeira. Dispatch received to-day announcing his death in Havanna from Yellow fever.

Thursday Oct. 28. 80

Bast fiber. Dean commenced a cutting mould same principle as the ones in use but smaller in which Bast fiber may be worked.

Water. Men putting up open trough from the Pond to an a sufficient elevation over gulley, in which water may be pumped and run into the Pond.

Interference. Evidence is being taken in the office in the case of Heath & Bush vs Edison according to Edison, and Blake & Wilson according to Batchelor.

Cables. The 25 wire cable & its branches and Mr. Edison's line & branches are again insulated and ready for the lamps as I am informed by Howell.

Indicated. Mr Clarke indicated the Engine this evening with shop running as usual but the dinamo machines all open and found 10 H.p. was being taken for shop & shafting

Shade holder The little frenchman finished a shade holder for Johnson composed of three arms with spurred ends and hinged at top to a fancy ornamental piece suitable to hold the socket of the lamp. below the top piece the arms are encircled with a ring which may be moved down on part of the arms which is made with a slight incline thus binding the arms toward each other and the spur under the flange of the shade, making a very neat and convenient fixture.

Testers To day Mr. Batchelor struck the dodge of doing away with the combination of the testers with the pump direct and permanent by treating the testing globe as a separate vessel and placing it on the regular pump as a lamp, it may then be sealed + the carbons put in and taken out by one man at his bench and thus avoid much danger of breakage both of glass and carbons.

Gasoline vapor Francis is still experimenting on heating carbons in vapor on the testing apparatus is today using gasoline and got off some few very fine appearing carbons. which Mr Edison directs him to have put in lamps for testing.

Water Dynamo taken to gully for pump motor for pumping water for Engine

Visitors. Maj Eaton. also Willie stopped a few minutes on way to Washington.

Print blanks started for home this a.m.

Sjorams Station Masons wedging between the walls and floor beams and cementing the space to stiffen the floor.

Large Armature. The long copper strips were received to day for the large armature.

Work general past week experiments conducted on heating carbons in gasses. Dean with assistants working on large armature and on mould for cutting bast fiber. Gang still on insulating conductors. John Ott finished wheel meter. in Gas fitters running steam piping at factory for heating purposes. Mr. Batchelor experimenting on and having pumps changed to but one tube with dryer and spark gauge attachment. Men at work preparing to pump water from gulley.

Regulation Sketches of apparatus for regulating electro motive force by Mr. Edison Book 60 pge 12 etc.

Street Lamps. on Monday night several lamps were put on line past Mr. Edisons barn and lit up, and on Tuesday night the entire line along Turnpike from Carmans to Factory was supplied with lamps & burned till nearly 12 o'clock. Burbank was here with stereoptican and tried it with the electric light, good but not quite powerful enough

Visitors. Beauman of Geneva with an interpeter here on Monday, Burbank on Tuesday.

Vulcanized fiber Bradley succeeded in cutting out a few strips from vulcanized fiber in the tools used for bamboo, which were given to Mr. Batchelor and as soon as a mould full can be cut. they will be carbonized and tried.

Tri cylinder Engine. A Garanne Patent tri cylinder engine was received to day. small probably 5 or 6 horse power. not yet tried.

Motors and Meters. Sketches dated on Sunday Made by Mr. Edison Book 60 pge 18 etc and also dated Nov. 2. pge 45 etc. same book

Water pump. The motor taken to the gully for running the pump crossed with the base and was returned to the shop an armature with pulley was put on the locomotive and run down yesterday pump connected and raised water to the troughs, which were found to leak so that they were treated to more tar and to day the pump was permanently set to work and is flowing into the pond a stream estimated about 10 gals per M.
current from Dynamo driven by the loco engine

Telephone Station. The telephone station up stairs in the Laboratory was completed to day connecting all the instruments in the park in a regular system.

Absent C. P. Mott. absent at home from Saturday afternoon till Friday night

Gasoline carbons. Six carbons treated in gasoline gas were taken to the Factory to be put in lamps. two put in and set up were exhausted and broken by Francis before any test could be made or results noted.

Visitors. Bederman in company with inventor from Geneva. inventor of rock drill. Black Boiler agent. Mr. Painter. Senator McPherson and Lt Armitage.

Absent Holzer sent to Corning N.Y. to see about getting small Pear shaped lamp globes.

Gasoline Carbon. Balance of nickel carbons returned from Factory in lamps this morning part of which were exhausted on a pump in the Laboratory one tested at 16 candles took 3225 ft lb Book No. 121 pge 116. Mr. Edison tried carbonizing the raw bamboo in a hot glass tube having gasoline vapor passing through it, but it proved a failure. he and Francis worked very late on ~~carb~~ treating carbons and carbonizing in the furnace with nickel moulds and gasses with varying success.

Balance Meter. John Ott finished a balance meter in which the plates of copper suspended from the ends are each immersed in separate rubber jars. it was set up for test in the Photometer room.

Rubber lined pipe another lot of rubber lined pipe for conductors was recd to day

Prints. Mott succeeded in making some very good prints by the blue process by using the original Patent Office drawing and giving it a few days exposure this means would save the expense and labor of making tracings for that purpose.

Large Globe. The large globes were to day carried into the black smith shop and cleaned and the extra ones were taken in the shop and fitted to the posts by Andrus.

Interior ~~disp~~ arrangements. Men commenced cleaning and painting interior of the Laboratory & all things removed from the shelves and cleaned and dusted preparatory for the painters.

Absent. Mr Batchelor at his house all day feeling considerably under the weather.

Canvass. Russell delivered another book of canvass in gas etc.

Saturday Nov. 6. 80

Rio Ginio Bamboo. samples of Rio Ginio Bamboo were seed to day. large, coarse and green

Armature cores. Logan is turning lignum vitae cores for the Large armature

Pond pump. The pump in gulley pumped into the Pond to day one & one half inches perpendicular raise in six hours

Retd. Mr. Clarke returned to day after an absence since Oct 29.

Work general, for past week. Upton & Hammer tabulating the statistics obtained by Mr. Russells canvass. Edison & Francis treating carbons in gasses. commenced putting out the Street Lamps. Dean & assistants on Armature. Cunningham on Commutators for same. Ott on Meters. Several men in Shop on Magnets &c of Large dynamo.

Sunday Nov. 7. 80

Work. Engine running and part of the men at work in shop The pump boys at Factory also working the pumps by hand in the afternoon.

Water leaders. Sometime during last night the heavy wind blew down the whole length of open troughs erected to conduct the water from iron pipe of pump to the pond.

Carbonization Mr. Batchelor is making some experiments in carbonizing Bast Bamboo and Manilla Hemp in the furnaces in the Labratory but with but partial success account of the nickel moulds melting on the inside and ruining the products

Mr. Edison had some inner parts made with four wires and clamps two of which clamped the ends and the other two about 1/4 of an inch up the carbon for experiments in building up the carbon between the clamps to make good end for permanent

clamping the first one tried was arranged so that the two ends were in multiple arc and one being a little longer than the other and consequently higher resistance they did not heat and accumulate in the gasoline vapor, wholly and he directed the wires to be run in such manner that the ends desired for augmentation would be in series after which better results were obtained. Some carbons thus clamped were treated immersed in kerosine oil and one placed in a lamp late during the night. Several staying up and working on the subject all night. The vulcanized fibre carbons did not pass well through the tests three only out of 13 proving satisfactory, they have not yet been put in lamps but appear well and are strong and leathery.

Reid Holzer returned on midnight train last night carrying with him a lot of glass for fall tubes of pumps

Tests Lamps. One lamp completed and with of our carbons carbon ends built up in kerosene last evening was tested by Francis but pronounced "no good" ~~the fault however probably being in the body of the carbon and due to the insufficient heat in that part.~~ He also tested the lamps sent from Factory as having been exhausted yesterday. An uncut Bast fibre was treated on the ends only and put in a lamp. sufficient current was put on to melt the copper wires leading thereto but without any perceptible injury to the carbon. it was then taken out and replaced in another lamp. The lamp first described in this note ~~as none which~~ was from information secured from Francis while testing: but later on inquiring the whereabouts of the second lamp enclosing the uncut Bast he acknowledges that to have been the lamps containing dry salt and that he does not know where he noted the results of the tests upon it. apparently testing for his exclusive information

Monday Nov. 8. 80

Interference. Evidence being taken here today on as telephone interference designated by Mr. Batchelor as the final telephone interference.

Dynamo bearings. One of the machines in dynamo room under the charge of Schmzer heated in the bearing to red heat and loosened the brass bearing so that it was necessary to remove the armature the bearing remaining on the shaft. Schmoyder was relieved of his charge and given liberty to seek pastures new.

Illumination. Mr. Edison's house having been supplied with new wires & fixtures was again illuminated with the electric light.

Tuesday Nov. 9 1880

Interference Evidence on telephone interference being continued to day.

Water. The leaders which were blown down the other night, were repaired and replaced and the pump again set running to fill the pond.

Wednesday Nov. 10. 80

Bamboo. Japanese bamboo about one ton was received to day but very damp and musty, but of apparently good fine grain near outside.

Interference evidence still being taken.

Building carbon ends. Andrews finished a clamping holder for securing the ends of carbons so that the current may pass in at one end, thence along the carbon to the second clamp, thence across to other end and out at the point or extreme end. ~~The instrument is composed of two~~

Nov. 10

clamps on each side each of which are impinged against the underlaying carbon by small thumb screws. in which position it is in readiness to receive the treatment in vapor or suitable liquid.

Thursday Nov. 11

Evidence continued and Mr. Batchelor and Mart Force searching for the original iron transmitter.

Friday Nov. 12. 80

Evidence continued.

Balance Meter. Nichols experimenting on the balance meter and is exceedingly well pleased with its accuracy and prompt action.

Dull. The heads are and have been during the week almost exclusively engaged on the Interference case, and no experimental work has been done or devices planned.

Saturday Nov. 13. 80

Heated clamp. Atkinson set up the arc lamp in the dynamo room and by two reflectors focussed the heat thereof on a clamp in open air and very readily heated it red hot.

Bed Plate. The bed plate of the Porter Allen Engine and large dynamo weighing 8400 pounds was delivered at the depot to day.

Burbank. A small engine and boiler sent here by Burbank to determine whether it would run one of the smallest dynamos with sufficient power to produce good light for his Stereoptican, was set up in the laboratory and run under one hundred pounds steam pressure. the small dynamo was attached but reduced the speed very much when work given it.

Work general of past week. Messrs Batchelor & Edison engaged principally on Interference case. Little doing at factory in consequence of delay in getting the semi-circumf. Men in shop pushing work on large dynamo & armature [illegible] and [illegible] to be built up afterwards

Ott at work on an Electric dynamometer.

New Mould. Andrews finished a new mould made deep to carbonize 100-12 carbons at a time. The tubes are [illegible]

 Sunday Nov. 14. 80

Water heater. The heater for the boiler water was set up in position to day and put in use about eleven in evening at which time the fires were started.

Room. The top of ~~wall~~ door leading from machine shop to dynamo room was enlarged and arched probably to make room for better handling heavy machinery &c.

Carbonization Andrews filled the new moulds with straight fibers getting 1000 nicely. Later Francis started fire in furnace but in handling the moulds shook up and slid the weights about so that the carbons were of no use, crooked and misshapen.

Gardner Engine. The three cylinder Gardner Eng was run empty awhile at night runs quietly and ~~smoothe~~.

Visitors Maj Wilber and family also a Mining Man whose name could not learn.

Monday Nov 15 80

Bed plate The bed plate for the Porter Allen Engine and dynamo was brought from the depot and gotten safely in the machine shop.

Hot clamp Acheson to day focused the arc lamp on one of the clamps of one of the Edison lamps sealed in the vacuum and heated it to red, but about that time the glass melted and the atmospheric pressure forced it in making a hole through the globe.

E. L. Co. The directors of the Edison Electric Light Co. held a meeting here this evening.

Visitors Reporter of New York Herald and some other gentleman interested in the Light Co. and nervous over the progress of Maxim and the United States Elec Light Co.

Bast fibre. A load of fine Bast fibre was received at the Factory to day.

Meter. Nichols to day runs the meters in ice and found it to work faster afterwards by steam heated the water surrounding the cup and the reverse in the action of the meter was the result he got the curve by the thermometer & thinks he can by proper resistances at the different temperatures make the action uniform.

Carbons. Mr. Edison and Upton are testing the resistance of some Bast and Bamboo carbons that have not been subjected to heat in the lamps. vary from 400 or 500 up to 2000. Book No. 106 page 63 &c.

Heat Factory The plumbers set up the boiler and turned steam into the pipes at the Factory today.

Telegraph. The Western Union wires were to day changed from the Office to front upstairs Laboratory.

Man Power. The large crank which was put up in the dynamo room and belted to the dynamo machine with small pulley used for pump circuit, one man at the crank let four small lamps and the Bush Arc lamp.

Rita. Mr. Upton returned after an absence since Saturday, family rita with him.

Papers. Sun and other papers of to day give some extracts of a lecture delivered by Prof. Morton in which he claims greater economy and stability for the Maxim Lamp than the Edison but acknowledges the superior efficiency of the Edison generator over all others. The Boston Journal of Nov. 10. brought by Mr. Upton yesterday contains a lengthy and fair unprejudiced article on the works &c. of Mr. Edison. Puck of this week takes off the light with tallow candles and the rail road with a hand car driven by man power.

Engine foundation Men are removing the soil from under the end of engine room, for laying a solid foundation for the Porter Allen engine and dynamo.

Bast fibre Herzig is experimenting on Bast fibre in acids and various solutions to soften & remove gum &c. without damage to the fibre Book 125 page 1 etc.

Light wires. Cables were to day wound & entrenched in the Laboratory Lot for the lamp posts and also run through under the rail road near depot and four of the large posts & globes set in there.

Sockets. A box of wooden lamp sockets and brass screws etc. for finishing them, were rec'd. to day.

Weight of Carbons. 6 Bis carbons which were carbonized in 15 minutes with a equal number that were heated very slowly and took 3 hours in carbonization were weighed carefully and it was found that those carbonized quickly lost about 12 per cent more carbon than those slowly heated indicating that the loops carbonized by quick heat are more porous and liable to internal arcing than the more homogeneous ones treated by slow heat.

Bast carbons. Some carefully made lamps with Bast carbons were tested and gave about 142 ohms at 16c. and were very even in economy. Book 124 page 15 etc. The lamps were set burning in the case in Labratory at about 16 candles

Papers. Herald to day publishes an article on the Maxim Lamp together with an interview with Mr. Edison on the subject nothing new striking.

Fiber. A package of dark, fine, strong, hairy appearing fiber was received to day from New York. has been tried before, but want to give it a more thorough test.

Building carbons. Having connected vaporating tube with pump. in tube placed zinc and Sulphuric Acid and tried it on the carbon in a lamp. but was unsuccessful in desirable results. built one up with gasoline (crystalized) and burned at 30 candles about one hour raised to an estimated power of 350 c. lasted 4 1/2 minutes Book No. 125 pg 3. etc

Papers. The Scientific American of this week date of Nov. 17. contains very good Article on the progress made in incandescing lighting and very justly gives Mr. Edison the credit of being the pioneer in that branch of lighting and rather ridicules the both sided course taken by many scientific men and particularly English papers

Elec. Dynamometer John Ott finished the Electric Dynamometer on which he has been at work for some time and delivered it in the Labratory.

Engine foundation, the floor of the engine room was removed the shape of the bed plate of the Porter Allen engine in a strip about six inches wide and masons will work all right on the foundation walls.

Iodine & Naphtaline } Some Iodine was put in a lamp and after exhaustion vaporized by heating the carbon. the vapor however attacked and destroyed the carbon near the clamps. pronounced no good. Later in evening Naphtaline and the chrystals of Naphtaline were tried, the chrystals giving a smoother and more perfect coating and building

Mercury. In the experiments on the pumps and lamps at the Factory last night the working of the mercury indicated impurities and on careful examination it was found to contain quite quantities of Plaster Paris which had been used as a drier in cleaning. Salt is now again used and believed to be a much more satisfactory drying element to use in the process of cleaning.

Saturday Nov. 20 80

Street cables. The cables to street lamps except about 1000 feet, again wound and relaid and lumber of shelter piled up, finishing all work on the lines for present. The last winding and insulation was commenced Sept 23rd and has employed an average of about twelve men on the work proper.

Paper. Prof. Morton publishes a card in "the Sun" to the effect that their report of his lecture published on Nov 17th was a mass of errors or misrepresentations by their reporter, but does not state in what particulars it is incorrect.

Large dynamo. The polar extensions of the Magnets of Large dynamo were placed on the large lathe preparatory to boring out the holes

Spark Keys. The single point spark keys used on the pumps were found to deteriorate rapidly in consequence of the spark at single

contact point. Mr. Batchelor in consequence is having Charley Flammer make a lot with double points to replace those now used.

Hot Mercury. Mr. Batchelor had tape put in an iron bottle in which mercury is transported and secured it so as to turn a gas jet under it and heat the mercury to 85 or 90 degrees. the plan was found to give much quicker and perfect vacuum and improve the general working of the mercury.

Work general past week. Bed plate for Dynamo engine placed in shop and some preliminary fitting of the parts effected. Discs secured on the armature shaft, and work on the commutator etc. progressing satisfactorily under Dean. Messrs Edison & Batchelor experimenting at factory on times for subjecting fibre to process of carbonization, on lengths of time and heat to apply to lamp on pumps, and on heating mercury and pumps. Mr. Clarke working on the relation and laws of motors to machine etc. Acheson on carbons by Electrolysis

Factory. during yesterday men were at work all day at the factory putting up heating and spare wires and putting iron stop cocks in all the top pipes leading to the pumps.

Carbonizing mould. Andrews finished yesterday a carbonizing mould with a round piece secured in the one end of the depressed centre and small weights to be secured on the ends of the fibre the plate of moulds is then riveted to secured upright on the bottom piece of the flask and the fibres pass around the round piece and ends hang down with weights secured thereto. was tried last night by Mr Batchelor. but he found an alteration necessary in the weights by which they slightly bend the ends and prevent the weights slipping off by the shrinkage of the carbon.

Engine. fresh packing was put in the cylinder of the engine yesterday by Alfred but so heated this morning that some delay was caused by stopping to repairs.

Buck eye. Mr Clarke is at work on the details and proportions of a dynamo for a Buck eye Engine to run 150 Rev. which he informs me is being made for the test or trial see B 116 & 121 etc

Electrolysis deposit carbon } Acheson is making some experiments to get a carbon deposit by electrolysis although he has obtained slight deposits nothing definite or positive has been obtained to warrant hope of success.

Magnetism zinc } Messrs Upton and Clarke made an experiment to determine whether the zinc plate on bed in the large dynamos could be dispensed with. Three small bars of iron were secured against the polar extensions and the yoke a cross piece on top of the poles and the galvanometer indicated a decrease of 2½ volts in the circuit due to the presence and contact of the bars

Papers. Herald has a short notice among the foreign items of the fact that the original or first Edison incandescent lamp is now exhibited in the Patent Museum at South Kensington. (Given by Mr. Edison to Col Stewart British Manager, at time of his visit here Sept 15.)

Annealer. One of the machines made for heating glass preparatory to blowing into globes (described May 28) was applied to annealing the outside seal of the lamps and is a very satisfactory apparatus for that purpose.

Heat. The boiler at Factory was insufficient in its production of steam, and to day a blast pipe was connected with the fire box. The blast runs the steam up very quickly but took too much air from the blasts of the glass blowers. the fire blast will probably be reduced to a constant one half or an inch supply instead of full three inch, the present pipe capacity.

Papers. The Evening Post of yesterday publishes a Reporters Interview with Prof. Barker in which the Prof. says that Edison's lamp is twenty years old, and that Maxim has found and now has what Edison has been looking for during two years past. (For consistency see paper of March 25. Also entry herein March 26.)

Armature. Dean tried saw for cutting out the large copper disc into proper strips etc. on the small planer but found it not sufficiently solid and is now preparing to arrange it on the Lathe used in cutting the iron.

Visitors. Maj Wilber here with an assistant from his office both at work on specifications some thirty cases of which the drawings have been prepared for by Mott and are awaiting the attention of the Major

High Vacuum. Last night six Bamboo lamps were sent to the Laboratory for experiments on high vacuum. Two were exhausted during the night by the pump here and burned about three hours before sealing off. It was observed that the vapory blue could be produced at the clamp, even when burning at low heat by holding a magnet near the glass and that as the vacuum improved the magnet required to be brought in closer proximity with the clamp to reproduce the blue, and the lamps were kept on the pump until no effervescence could be produced by the aid of a strong magnet. They were tested by Francis and found very economical and were perfect in appearance.

Belt strain Mr. Clarke in his investigations of the relations between generator and motor establishes or rather discovers the fact that in machines of the same constitution the strain of the belt driving the dynamo and

the strain on the belt from the motor to the driven machinery will be the same, when doing their maximum work, regardless of the speed or external resistance or loss on the lines.

Chemically treated carbons } Fourdrinier carbons were treated chemically by Dr. Haid to remove all organic and foreign matter. Comparatively a small amount of impurities were found yet enough to possibly be deleterious. The carbons were then sent to the factory to be measured and those of suitable resistance sealed in lamps to be returned to the Laboratory for exhaustion and test.

Condenser in Lamp } Hammer made small condenser of alternate sheets of mica and foil connected with wires of lamp below the clamps. Sent to factory to be put in and exhausted.

Visitors. Reporter of Tribune, shown around and explanations given him by Mr. Edison. Also Biederman & friend.

Thursday Nov. 25. 1880.

High Vacuum. Last night Mr. Edison, Herig and assistant run a pump on a lamp until about three o'clock this morning when no blue could be brought to the lamp by a powerful magnet and were about ready to seal off when all dropped asleep lost their vacuum and lamp.

Absent. Snowing all day this Thanksgiving. D.D. Mott, Nicols, Acheson, Hammer and several others absent from Park still more absent from Works. Dull, quiet,

Friday Nov. 26. 1880.

Papers. Tribune to day publishes the interview of their reporter with Mr Edison which in the main is a correct report. They do not however go much outside the statements of Mr. Edison. Evening Express interview of Sawyer, favorable to Edison and his success anti [illegible].

Factory. Partition put up in second story dividing the mercury department from the stairway etc. Glass Blowers removing the carbons from four or five hundred lamps in which they had been secured by clamps other than Platinum to put them in Platinum clamps and Pear shaped globes with wires through the flat seal. The iron pipe for power pump all in place and the boys are running mercury through carrying considerable dirt and dust each time.

Buckeye. Mr. Clarke is preparing a contract with binding specifications for signature of the Buckeye engine Co. previous to their building the 450 h.p. engine for experiment and use there or elsewhere on large dynamo.

 Nov. 26. 80.

Armature. Dean tried his machine attachment for bending the copper strips in form for the armature and finds it to work very satisfactorily

High vacuum. Engine run all really all night again for current for the experiments in the Laboratory on high vacuum; one lamp, gotten off the pump with exceedingly high vacuum in which a powerful magnet produced the blue in the form of a vapor or diffused halo around the Platinum wires

Decorations. Mott made a bracket and small light socket from rubber scrap, small and airy, and was requested by Mr Edison to work it up in economical commercial form.

Saturday Nov. 27 1880.

Glass. Six tierces and three boxes of Globes and tubing received from the Corning Glass works this morning.

Water Engine. Not running this morning in consequence of water. The Pump in gulley started and about eleven o'clock water enough had been pumped in the pond to warrant starting up.

Papers. The Times to day publishes two articles touching upon Edison and the electric light. The one intimating that all substances tried for carbons so far have been unsuccessful and that the perfection of the carbon and lamp depends on the discovery or use of some other vegetable production not yet tried by him and that Mr Branner will sail for Para on Decr 4 in the City of Para to gather and forward from Brazil all her fibrous woods vine grasses &c.

The other is a short editorial stating that Morton and Bailey claim only for Mason the invention of using gasoline vapor in lamps as something of great value if not entirely essential to the perfection of an electric lamp and further that although Prof. Edison and Sawyer accuse him of stealing and copying from them, they have not stated in what particular nor dates when they used or devised any of his claims.

Absent C. P. Mott left for home at 11.20 A.M.

Work general of past week. Mr. Batchelor and assistants preparing the pumps and pipes for the power pump and clean mercury. Mr. Edison with two or three assistants making experiments on high vacuum or pumps in Laboratory. Dean and several assistants pushing work on the large armature, Logan and others on Magnets. Frame etc. of large dynamo.

Returned C. P. Mott returned from visit home at Midnight last night.

Visitors Learn that Sarah Bernhart was on visit at Laboratory on Sunday. To day Norvin Green Goddard and several others.

Carbon carrying I find in Book No. 123 page 93 etc. sketches and notes made on the 28 & 29 Nov. by Mr. Edison of ways and means to prevent or compensate for the carbon carrying over, on the loops. One of which is a tapering loop. for this subject see also June 16 under head "Spectroscopic Bast carbons".

Interference Evidence which was commenced on Monday on Quadruplex interference is being continued today in the office.

Coal dust Men were sent here and on Sunday prepared the fire box of Boiler for grates for burning dust coal, with intention of making an experiment of burning it directly under the boiler.

Chemically treated carbons } Park. The carbons treated by Dr. Kaid mentioned under date Nov. 24 which were taken to the factory were put in lamps and sent up here, and exhausted Monday night the treatment, so far as I can learn, was not considered beneficial, at least not enough so to warrant the labor of treatment.

Buckeye Contract. Mr. Clarke finished the contract between Buckeye Engine Co. and Edison Electric Light Co. ready for signatures and duplicate commenced by C. P. Mott - covering 18 pages.

Absent. Mr. Clarke went to New York carrying with him the contract with Buckeye Eng. Co. intending to go thence to Philada.

Papers. "Tribune" publishes a letter of L. Bohm denying the assertion of Mr. Edison that he is a boy of seventeen or was enticed away by Mr. Mason.

Vacuum experiments. All experimental lamps, and pumps used at Laboratory on experiments on high vacuum were removed to the Factory and Herrig & his assistant will, under the direction of Mr. Edison, continue the experiments.

Electrolysis. Acheson in trying Alcohol as a solution in his experiments in depositing carbon by electrolysis was unable to get any action, he then let it stand in lime a short time after which gas was freely formed in the solution.

 Decr 2. 1880.

Large Armature. Logan has turned off the discs of the Large armature and to day commenced the grinding and finishing with emery wheel.

Factory. Steam pipes are now run parallel with and adjoining the upper iron mercury pipes and the two wrapped with cotton ~~to heat the mercury~~ for one tier of pumps to heat the mercury, and for resistance additional to the boxes already in them Lamps are enclosed in a tight box & thrown in or out by plugs from outside.

Letter press record. also Bill heads and letter paper with heading The Edison Electric Lamp Company. T. A. Edison Chas Batchelor F.R. Upton. E. H. Johnson.

Friday Decr 3rd 1880

Rails test. The rails of electric Rail way, through which the current is conducted to the pump motor in the gully, were tested by Mr. Upton and found to be down to 24 ohms. Still the motor runs and does its work.

Hydraulic press. The small two cylinder engine was moved from the dynamo room into the Laboratory and connected up and with the pump of the Hydraulic press, to use it for pressing the ends of the copper bars of the large armature.

Vacuums. The five hundred pumps made ~~last winter and~~ spring have all been changed, broken, altered and abandoned, and the glass blowers are now at work on an order for two hundred without spark, or McLeod, gauge, but single tube with dryer reservoir and probably to be tested for vacuum by magnet and "blue". Consequently the

Spark keys and wires were abandoned and taken down. Herrig to day moved in small room in the supplemental building and is continuing his high vacuum experiments. has to day very large globe encasing the regular carbon to exhaust for observations in the effect on carbon carrying. Francis is also making some experiments on pumps and vacuum in the small front room of Laboratory. has in trial a pump with two fall tubes in which the mercury is conducted from a small reservoir into which it is also deposited through a fall tube with contraction thus getting a vacuum on the mercury before its final use for exhausting the lamp. to day results unsatisfactory.

Conductors the light lines to factory were to day increased in capacity by the addition of extra No 10 wires as far as R.R. crossing

Papers "Times" contains short foreign dispatch to effect that judgment was deferred in the case of Post Office Department vs. The Edison Telephone Co. of London.

Returned Mr Clarke returned from Philada. this afternoon and reports the probability of the Porter Allen engine being shipped the last of the coming week

Pump. The screw pump for mercury ordered of Morris & Tasker by Mr Hume personally Sept. 25 was received in car on the switch to day.

Gasoline Hammer carbonized some loop shaped wide card board and is introducing gasoline vapor in the bell of the hand air pump and passing the current through a regular loop passed placed therein on the wide carbon. and is getting very nice coatings and fine appearing carbons.

Work general part week. work on large dynamo. Glass blower making pumps. Mr. Batchelor preparing for pony pump. Mr Edison experimenting on high vac and Lamps

Monday Dec 6th 80

Papers. The "Sun" of Sunday has report of interview with T. A. Edison again giving twenty days from date as the time for the demonstration with Porter Allen engine and large dynamo.

Small dynamo. The armature of one of the small dynamos or motors was rewound with four wires of fine connec[ted] dup[licate] for running as generator at the factory for current for testing etc.

Visual Indicator. McKenzie is making some experiments on working Ponds visual indicator with a magneto call and thus avoid the use of batteries in subscribers houses. He succeeds in operating the indicator every time by the magneto but as yet has not been able to get the desired combination with certainty.

Motor. The dynamo machine standing unused, in consequence of arc in armature, up stairs in Factory was to day brought

up to be used as Motor for running blower for drier room for burning dust coal.

Pumps. Men cleaning the power pump, and Mr. Edison making experiments on the vacuum pumps. The feature therein occupying their attention being an arrangement by which the contraction is in a separate tube and may be removed cleaned, or replaced without injury to the pump or the necessity of taking it down. A tube of small diameter is contracted at a suitable point, preferably near the lower extremity and is passed down into the tube where the mercury is introduced, the upper end passes through a rubber cork fitted in the lower ~~is sealed in Mercury~~ end of a reservoir formed like the testing globe in which the mercury is placed. And by passing down the small tube is deposited without dropping into the lower end of first or conducting tube and thence through the cross tube which is slightly enlarged near the outflow, and thence in and down the outflow tube carrying the air with it.

Albert Clarke in N.Y.

Mercury cleaning. Dave Hickman ground a quantity of glass for filtering Mercury; tried it in a tube and found it answered admirably. Dr Haid also cleaned some very thoroughly by severe shaking and then filtering through paper funnel, these operations are suitable only for removing mechanical impurities. Dr holds that the thorough shaking concentrates the impurities and which are then more readily removed by the paper filter.

Pumps. The extra tube contraction did not get down to fine work so completely as the Batchelor standard pump and will probably not cause any change to be made in the order to glass blower to make 200 of the standard. Power pump gotten in position and nearly ready to start.

Electric Dynamometer entirely completed with mirror scale etc. and a thorough test made of its reliability by Mr Nichols.

reverse currents either direct or through the coils in their respective sphere give same deflection on the scale either right or left and is believed by him to be both valuable and reliable for station uses.

Silver Solder. Dean made a commencement in soldering the parts of Large Armature with silver solder and got good results on a couple after considerable trouble the heat not being intense enough, with the four burners from the supply pipe, and blast of fan blower other gas connections will be made and an effort to get better blast.

Interference. Evidence again being taken again in Quadruplex interference and Serrell here with Wilber

Silver soldering. Dean abandoned gas as a means of silver soldering the parts of large Armature. and is having better success with charcoal fire.

Loss by Local current of Mchn. } Mr. Clarke is making measurements etc to determine the loss in the dynamos by local cutting or currents and friction. He uses one machine as generator and one as motor or driven machine, taking the amount of current generated and speeds of machines he then reverses the machines as to motor and generator to get the mean or average. The laws of generator and motor with relation to each other have been so thoroughly demonstrated as reliable that this means of determing the loss by local current is considered perfectly reliable

Interference Evidence still being taken in the quadruplex case.

Lamp. Holzer to day showed me a lamp that was made yesterday by Hipple in which the tube for exhausting was passed through the inner tube and sealed through it between the clamps and the point of sealing with outer globe and doing away with the tube on top of globe, after vacuum is obtained the tube is sealed off even with the lower end of inner tube and there does not show as part of the lamp. difficult to make however, and for that reason probably impracticable

Screw pump. run to day. with mercury pipes being connected only from one reservoir to the other. although run at slow speed it passed the mercury up very nicely and very encouraging results are reasonably expected.

Vacuum pumps some have been provided with tube shaped reservoir containing ground glass through which the mercury will pass into the exhaust tubes

Interference. Evidence resumed in the general telephone interference case.

Papers, The American Machinist of this week speaks of Maxims Lamp as accomplishing the results sought for by Mr. Edison and states that the gasoline vapor is removed after the carbon has been heated and built up at weak points.

Telephones. Mr. Bergmann brought out a couple telephones constructed to receive the sounds from greater distance from the mouthpiece. they were put up and tested by McKenzie, would receive and communicate the sounds at a greater distance from transmitter than the ordinary telephone and are a neat instrument the diaphram being placed near the back of instrument and the funnel shaped mouth piece, all sunk in or inclosed in the case.

Loss test. Berdeman's engineer making test of generator, used No 10 wire on the commutator to see whether he had a current, got it. used waste and thermometer to get heat of armature while engine stopped to oil. on restarting succeeded in getting the thermometer and fingers out but the waste was lost and so was armature. use by him of the machines delayed Mr. Clarke in completing his measurements of loss by local cutting etc.

Screw pump. Pipe connections all made and pump carrying abundance of Mercury at low speed and with apparently little power, it is believed the pump will supply mercury for 500 vacuum pumps.

Friday Dec 10. 80

Papers. Truth hails the introduction or proposed introduction of the Brush light on part of Brodway as a grand Christmas gift to the citizens of New York, says that no one now expects the Edison Lamp to do household duty, but thinks that some one will produce one for that purpose.

Large Magnets. Logan finished winding with 6 layers of double wound No. 10 wire and mounted one of the magnets of large dynamo on its base.

Sealing off. A spirit lamp was arranged with a goose neck glass tube, secured in a bracket mounted on the neck of the lamp, with a small rubber hose attached for sealing off lamps with straight exhausting tubes, sent to the Factory.

Visitor. Dale, agent of the Inman line of Steamers. is anxious to have Mr. Edison put the lights in their new Steamer "City of Rome" and took socket

of electric lamp in which to fit the oil lamps. and make them interchangeable.

Screw pump. have been most of the day running mercury through the pump and pipes for cleaning them and are getting them in pretty fair order.

Absent Mr. Edison has not appeared about the factory or any works to day

Case Lamps. The last of the eight bast lamps in case broke in carbon to day after burning 211 hours

Field & E. M. F. Mr. Clarke made tests of saturation and comparative test of current on field and on line Book No. 116 page 157 etc. Most economical current on the magnets was 3789. ft pounds or 7.6 Vebers which gave saturation, and after that point current added to the magnets gave very little increase in current.

Saturday Dec 11. 1880

Carbon deposit. Hammer and Howell are making further experiments in depositing carbons from gasoline vapor in the mechanical vacuum pump. The loops are laid on wider strips of card board carbon in the bell of the pump and ~~after getting~~ gasoline is introduced they have got slight deposits on the loops. but so far have not got it on the clamp where most desired

Electric Dynamometer. Mr. Nichols determined the constants of the low resistance dynamometer, and made scale from which the economy of a lamp may be read. Book No. 118 pge 47 etc.

Grate bars. The grate for burning coal dust were secured to day and fires let down at five oclock for putting them in and making the change.

Visitors Reid. Lawson put in his appearance this morning having arrived from Colorado late last night.

Work general of past week. Screw mercury pump put up and prepared ready for work. Work in shop progressing on large dynamo. Logan winding cores of magnets. ~~[illegible]~~ Ott on a meter with four mercury cups for contacts. McKenzie trying to work call box with magneto current generated by the magneto call box of Johnson. Mr. Clarke making measurements to determine the loss in dynamo by local cutting. Nichols determining the constants for the low resistance Electric dynamometer.

Double loop lamp. Mr. Edison had lamp made with two loops clamped in same clamps but standing apart. on heating it the loops further separated contrary to expectation under the law that like currents attract.

Coal dust Exp. Grate bars and discs for burning dust coal, were put in yesterday but blower not ready and coarse coal being used.

1 H.P. Motor. One of the small machines mounted as a motor by Bergmann was received but several changes found necessary before trial can be made.

1/4, 1/3 & 1/2 lamps. Mr. Edison had some lamps made with carbons 1/4 1/3 & 1/2 length of the regular, for use in series or instead of one across in multiple arc. one of 1/4 and one of 1/3 lengths where exhausted and intensely heated, vacuum was obtained on them in 35 to 40 minutes the globe etc being small

Screw pump. doing regular work to day and a number of lamps exhausted. one tier of vacuum pumps was completed and arrangements made for running through all the lamps possible tonight. The lamps are connected by the straight

exhaust tubes and sealed off by the blow pipe spirit lamp (Decr 10) which works very satisfactorily.

Photometer. Mr. Upton to day brought two Student lamps with incombustible burners one to be used in the photometer for the factory, the candle power as tested by Francis was twelve. Chas Flammer finished the photometer and secured the lamp thereto and it was blackened and taken to the Factory.

Visitors Mr. Lowrey and Son here in the evening.

Produce Vacuum. I find in book No. 106 page 85 under date Nov. 17. sketch and description by Mr. Batchelor of idea of obtaining vacuum by heating carbon in a globe to which is connected by tube with stop cock a lamp, also a second tube with cock unconnected, heat carbon expells the air through the latter, when its cock is turned and communication with lamp opened, to allow the carbon to absorb gases & air admitted from lamp.

Factory lamps. Excellent success was had at the factory during the night up till two oclock when the engine was stopped for negligence or carelessness in the attendant not supplying water. about twenty lamps and twelve pumps were broken by the sudden loss of vacuum. Martin Lees discharged for the accident.

Coal dust. Blast driven by the electric motor was started under the boilers and fires ~~fixed up~~ started with dust coal, worked very well until about noon the motor did not work properly and fires got very low, but brought up and burning good the balance of the day.

Papers. "Truth" to day devotes a column to the Brush Arc light and the prospect of lighting Brodway from 14th to 34th Sts with 22 2,000 candle power lamps on 25 foot posts. supplied by current from 5 dynamos. driven by a Corliss Engine. winds up with a slight rap at Mr. Edison for having told an appointed Committee man that if he wanted light right away he had better get some other.

Visitors. Prof. Praeger with two ladies.

Photometer put up on track near the pumps to test the lamps before sealing off. All the lamps are now heated quite hot before placing them on the pumps. by which it is found that vacuum may be gotten much quicker.

Measuring box. By a misunderstanding between Clarke and Dehl a very heavy current was put through the resistance box. and a larger proportion of the coils destroyed.

Local loss. Mr. Clarke finished ou testing measurement of the loss on the machines by local currents and friction. The total local loss he found to be about 15.000 foot pounds or a little under 1/2 h. p. has not yet determined how much is due to friction but thinks the greater portion is by the friction. Will make another test for comparison and proof. Book No. 116 page. 161 etc.

Electrolysis Acheson is still continuing the experiments to deposit carbon by electrolysis but has as yet obtained no favorable results. Book No. 155 page 1 etc.

Carbon plating Lawson, called to the Factory and set at work on plating the ends of carbons with copper etc. in small room in Supplemental building

Sockets. George Hickman is at work boiling the lamp sockets in Alcohol and rosin. giving them an oiled appearance

1/4 lamp. The lamp with carbon of one fourth length was burned at 16 candles for a time then put in series with the one third carbon and the two raised to 32 candles. The 1/4 was then put at 24 candles and burned 2 1/2 hours before breaking.

Visitors Mr. Biederman says Maxim knows all that is being done here even to the number of working pumps and lamps taken off.

Small dynamo. one of the small dynamos wound for the purpose, was taken to the factory to be driven as a generator by one of the motors there, to give current for testing and use at pumps

Interior decorations. John Ott finished & tried a ~~dove jointed~~ bracket with two joints which might be turned completely around without effecting the current or connections. It is quite ornamental and worked very satisfactorily.

1/3 lamp. The lamp made with one third length carbon was put on Photometer at 24 candles last night and burned 16½ hours.

Pump supports, Moffett suggested and tried supporting the pumps by placing a ~~mort~~ piece of timber at the bottom mortised to receive the tenonted end of pump board, and spring clamps to hold the top. the top in trial was however

held by a fork shaped clutch secured on the board which took into a half slotted piece secured on the supporting timber. The idea met with favor and will be adopted.

Small Elec. Engine. The one horse power engine mounted by Bergmann was tried last night but no power could be had from it. Some defect which the electricians could not discover although working on it till twelve, thirty.

Absent. Acheson sent to Greenpoint to the petroleum distilleries for the products remaining after distillation brought six products. one of crude oil, one of the tar 2 of coke 2 of wax. All differing greatly in appearance and body.

Water. Water supply exhausted and again with team drawing from the brook all day.

Dynamo Station. Acheson is twisting cable for coupling the machines in Multiple Arc for the lamp lines, introducing a no 10 wire from each machine of a line, or about five machines to each pair cables.

Vac Pumps. forty six pump composing one line was completed to day, and all the pumps working on lamps. about six o'clock 44 lamps were put on and exhausted very satisfactorily.

Plating Lawson is plating the carbon ends at about eight an hour, and Henry is conducting experiments for uniting the wire and carbons direct by plating them together without manufactured clamps

Small dynamo. The small dynamo at the factory for current for testing is run from counter shaft driven by the blower motor. does not give so much current as expected but enough for the purpose.

Gas Furnace. Mr. Andrews finished a model of the gas furnace, for Patent Office. they in this case requiring a model.

Papers. "Evening Post" gives another column to Brush and his lamp and experiment in Brodway.

one horse power. The engine mounted by Electric Engine) Bergmann, was again tried but no go. Mr Edison found the bug in the winding of the Arm Magnets and corrected it by connecting top with bottom ends after which it was belted to a lathe and run a six inch saw through one inch copper bars at fast speed occasionally slipping the belt, but did not stop. the power required was not determined.

Work general for the past week. In the shop work has been pushed forward on the large dynamo. and Ott finishing up Lamp sockets. At the Factory the glass blowers on pumps and lamps. and Moffett mounting and putting up. new device for securing the pumps adopted, and the castings ordered. Lawson working on plating the ends

of carbons and Herrig experimenting on plating carbon and wire together. Second experiment on burning dust coal direct under boilers tried and so far with fair success. Lamps being tested and put on the lines preparatory to illumination on Sunday and Monday nights.

Blower power. The electric motor taken out of boiler room and small upright engine set up to run the blower.

Illumination: 143 outside and about 49 inside, were lit up last evening, making a total of 181 Lamps and the engine tested for economy and indicated by Mr. Clarke. [Economy test] [copied running the 5 Dichno & 1 field.] Average area of friction diagram. Back end .30 sq. in. Front end .57 sq. in. Indicated H.P. 12.46 – Average of diagram with lamps on. Back end. 1.45 sq. in. Front end 1.525 sq. in. Indicated H.P. 41.55 – H.P. due to 183 lamps. 29.09 – or 6.3 lamps per H.P. The amount of water per hour by indicator was 1429.91 lbs or 34.4 lbs per H.P. per hour. Mr. Clarke says that the amount of steam used by the engine should have given 7.3 lamps per horse power, otherwise that a good engine should have given the same results with 30 lbs of steam per hour, per H.P.

Visitors to last nights illumination, Mr Biederman and some friends –

Coal. For the present the pea or dust coal has been dispensed with and large coal is in use under the boilers to day.

Small elec. engine. taken up stairs in the Laboratory to day but again "bugged" up and took all the afternoon to get it to run, Mr. Edison finally directed the connections and again got it to working.

"Layout" Visitors Aldermen } In the evening, by invitation, the Aldermen of New York City were here to see the working of the lamp and system, and to partake of both solid and fluid refreshments. The room of Laboratory was illuminated with 37 lamp and presented a fine appearance. ~~overall~~ about ~~225~~ 239 lamps were illuminated. The boys had their racket at Davis's – Part of whom celebrated at their own expense.

 Tuesday Dec. 21. 80.

Papers: "Sun" World, Herald, Truth and Tribune give fair and favorable reports of the display and visiting here last night. Also dispatches that the suit in England of the government vs Telephone Companies was decided against the Telephones holding that they came under the telegraph act.

Carbonization. Acheson is making some experiments on carbons by request and direction of Mr. Edison, soaking the material (cardboard) in different products of petroleum and carbonizing, and repeating the process. No satisfactory results have yet been obtained.

Clamping by plating. Lawson has clamped some carbons to the leading wires by plating and is continuing the experiments. Also and to plate the ends of all carbons.

Generally thinking these we shall [illegible] and serve including to [illegible]

Wednesday Dec. 22. 80.

Motor test. The one horse power electric engine was again tried tonight but does not work satisfactory as regards the current and produces too much fall on the lamps of the line, giving a drop equal to the current of about six lamps. On this current, about equal to one horse power, it run 2630 revolutions with 92 volts on the line. The governor is also unsatisfactory because of its noise and the effect on the lamps. Mr. Edison suggests to govern on the field by throwing in or cutting out coils and thus strengthen or weaken the field.

Fall on lamps. Thirty two lamps were in circuit and one measured in the photometer room gave 9½ candles. Twenty four were then turned off and the photometer lamp raised to 15 candles.

Visitors Brown & Waterhouse with arc lamp and ingenious mechanism for regulating.

Absent. Mr. Edison at N.Y. Clarke also absent & Batch-

Engine. As a compromise and with better results Large coal is being mixed one half with the dust under the boilers and water supplied by team drawing from the creek.

Motors. Mr. Upton making some tests of the one horse power motor to determine if possible whether sufficient improvement can be made in the winding of armature or proportioning to prevent the irregularity it now produces on the lights. The armature was taken out to rewind with higher resistance than its present .6 ohms and Mr. Edison suggests it be wound for about two ohms.

American Union wires were to day connected with the Laboratory for telegraphic communication.

Lamp tests about thirty lamps were tested at the factory for the first testing with electric dynamometer and Photometer.

Visitors Harlin of McNab & Harlin, with three friends.

Absent C. P. Mott returned after absence since Friday noon.

400 Lamp test. 400 lamps were burned on Friday evening, Christmas eve, and Economical test made of the Engine by Mr. Clarke, boilers forced to 90 lbs. pressure engine to 75 Rev. gave 6.9 lamps per horse power, but I believe, this result is obtained after deducting the power consumed in friction of shafting etc.

Well On Friday morning some lumber etc. was delivered and preparations commenced for sinking a driven well at the Machine Shop. On Monday morning actual work in sinking was commenced.

Factory The second tier of pumps have been nearly completed but an accident causing the absence of Van Cleve put back the carbonizing and

~~It~~ insufficient Lamps have not been made to yet require the additional pumps.

Motor. The mounted one horse power Motor armature was rewound two ohms resistance and the governor removed, A line of shafting put up in the Laboratory and Motor tried this morning It run very satisfactorily and had no very appreciable effect on the lamps burning in same circuit.

Carbonizing. Mr Acheson in his experiments on carbonizing in connection with Products of Petroleum placed a mould while hot from the furnace in ~~Alkali~~ thoroughly covered and protected it from the air, the mould, although an old black one, ~~It~~ came out of the sand white and natural nickel color.

Papers "New York Herald" contains dispatch from Philada: that the Porter Allen engine is completed and ordered shipped to Menlo Park. Also that the Law Committee of the Board of Aldermen to whom was referred the application of the Edison Illuminating Co. for privileges of laying their wires in the Streets, had reported a resolution that that Co or other Elec Light Cos have the privilege by paying to the City 10 cts per foot for the Streets disturbed and after five years pay ~~the~~ three per cent of their gross receipts.

1/2 Lamps. 7 full lamps were put at 48c and 17 half lamps at same incandescence or 24 candles for a comparative test of their usefulness. The halves show much greater tenacity than the wholes. Although the latter give an average of 12 hrs 17 m. against 5 h 48 m the average of 100 tested Oct 12.80

Absent. Mr. Clarke took train east 9 20 on return says all papers signed and bargain closed with Buckeye Engine Co for 100 horse power engine to run at 350 Revolutions. Mr. Edison also left for New York at 11 20 returned early evening.

Carbonizing. In view of the effects, discovered by Acheson, of excluding the air from the moulds while cooling, Mr. Batchelor sent to Laboratory and collected the ashes of the old furnaces, to use for burying the flasks at the factory.

Snow. Severe snow storm continued all day.

Power. No power in the forenoon, changing the pulleys for the Logan's Lathe, water scarce and weather so exceedingly cold and windy that the men cannot stand it to draw.

Plating & Governor Sketches } Mr. Edison made a sketch of a governor for an electric engine operating directly on the shaft and effecting its purpose by moving a lever or other suitable device over resistance coils or boxes throwing them in or out as the case may require. Also one of Apparatus for plating carbons to the wires without use of clamps, being a vessel containing the plating solution in which one electrode is placed, the inner part containing the wires to which the carbon is temporarily attached is passed through a rubber cork which forms the bottom

of the vessel or reservoir. the other or opposite electrode is connected to the wires extending out of the inner tube which extend together with the tube through the cork sufficiently low to immerse the ends of the carbons say 1/8 of an inch. As the plating progresses the wires and carbon are united (and held by the deposit. Sketches dated by him Decr 24. and taken to Motts table for Patent Office drawings.

City of Rome. Mr. Clarke commenced the drawing work on the details of the Dynamo & engine for the Steamer City of Rome of the Inman line, now building.

Chandelier the second twelve half lamp chandelier was completed and taken to Mr. Edisons house

Watch. C.P. Mott remained up all night to discover if possible the person who has been on several occasions removing the plugs of the American Union wires from their propper position in the switch board. Not disturbed. About six in the morning the steam pipes thawed out in the Laboratory and soon filled the chemical room with steam.

Present. Mr. Edison received to day from McLaughlin, Powers & another friend, a Present of a very hansome gold headed cane

Smothered moulds. A mould at the Factory was buried in ashes while hot and allowed to remain all night. The carbons tested to day were found very high resistance from 350 to 700 ohms. Mr. Batchelor had sheet iron hoods or encasing boxes made in which to place the moulds ~~in~~ Petroleum. gum or other gaseous materials having been first placed therein and by

the heat of the moved gas generated to act upon the moved in place of air.

Factory Management) Notices were today posted at the factory to the effect that on and after Jany 1,81 Mr Upton would take charge and management of that place

Sample Bamboo. Bradley cut some strips from Bamboo which he believed to be samples sent by man sent to Japan and China. it is exceedingly fine and unusually free of pith, came out very fine from the carbonizing flask.

Absent. Mr Clarke gone to Philadelphia. Visited by reporter etc.

1880 The closing month of December gave two new moons and eclipse on the sun this morning. very cold weather and about 400 lamps in readiness for

Lighting New Years night

Carbonization Acheson placed sticks of ordinary charcoal in tube in the opposite end of which was placed ~~Kerosene~~ Petroleum pitch. the end containing the carbon was placed in the furnace and gas flame burned under the outside end to make gas from the pitch which passed through the tube and ~~[illegible]~~ through a small hole in carbon end. one treatment gave a steel like metallic look and ring to the sticks, He also observed that if the gas was shut off from the carbons while still very hot the deposit was more metallic or that by allowing the gas to come in contact with the carbon after partially cooling the deposit was dull black. thus solving the problem of the cause why in previous trials the same results were not always obtained

Holiday. No work in shop to day and but one or two at work in Labratory finishing preparations for burning to-night about 400 lamps.

Illumination & Economic test } In the evening 408 lamps were burned and a number of visitors were here to see the display. Mr. Clarke made a test of the engine while running for the lamps and developing 82.3 horse power and got ~~exceedingly~~ perfect diagrams. Boiler pressure 110 lbs. Revs. 75. Total H.P. 82.3 less frictional diagram left net of 61.95 H.P. or on 408 lamps gave 6.59 per H.P. less fuel gave net 7.88 per h.p. or 22.58 pounds steam per H.P. per hour. Proving the Brown engine first class for economy etc.

Papers, World publishes report of visitors yesterday, mean untruthful report. headed Edison Melancholy.

Driving belt. The Large main driving belt was respliced and tightened yesterday while the engine was idle.

Well. Men have gone down 65 feet with the well and to day swung their machine around and belted it to their own engine, The belt not holding well on the pulleys of inside shafting were at first used.

One half Loops. A lamp was sent up from the factory with two one half carbon connected therein in series and facing at right angles to each other. Also one with one full loop & a ~~loop~~ ~~or~~ rather one half of a full loop the half being a broken full one and unconnected at the upper end. Also one with condenser of mica & foil. All for experiments.

Visitors Mr. Green. Worcester Mass. and friend to talk and get what information he could on getting the light introduced in his dwelling house. Also Hopkins of Scientific American with artist taking sketches. Also Biederman in the evening.

Lead cable. One box with coil of Lead insulated wire. three wires each in small lead piping these in turn enclosed in one. Large one about 5/8 inches was received at the Laboratory.

Lead Insulation Francis has been testing the lead encased wires on telephone and sounder and finds some induction Especially Noticeable with the sounder.

New Engineer. New man formerly with Maxim and U.S. Elec Light Company is now here assistant with Swanson in running the engine.

Porter Allen Engine. The Porter engine was received to day not yet unpacked.

Visitors Mr. Wilber here a few minutes in the morning. Also Goddard and party of friends and Hopkins with friends in the evening.

Economic test. Mr. Clarke indicated the engine again ~~Last &~~ to night on Nine dynamos & one field supplying 464 Lamps. Engine 78 Revs. with as high as 115 lbs steam pressure.

 Jany 4-

Platinized carbon. Lawson boiled some carbon loops in Aqueous solution of Platinum chloride, believing that when heated in vacuum on pumps the chlorine will be driven off, leaving the platinum in the pores of the carbon in a finely divided state - But what will the platinum do when the loop is heated to high incandescence? - trial will show.

Governor, a governor for throwing in and out resistance, according to the speed was finished and put on the small Elec. engine up stairs - no connections yet made with resistance boxes.

Wednesday Jany 5th 81

Clamping: Dr Moses melted a pair of silver clamps in a globule on the end of the platinum wire and while hot inserted the ends of the carbon loop the silver cooled and firmly held the carbon with very little injury to the carbon by oxidization, he thinks that by turning a cooling gas on the globule immediately on inserting the loop all injury could be prevented.

Factory additions. Masons are working on the foundations and carpenters on the frames etc for addition to the new building for carbonizing also addition to front of old building for store house etc for glass.

Sockets John Ott finished a pair of sockets for B. lamps with key at the bottom acting on a spring which forms the contact same style and principle of one made by Mott Nov 26. except in the Mott socket the

acted and formed the connection direct, without intermediate spring.

Governor. Francis connected four small german silver resistance boxes with the plates on which the spring of the governor contacts in such manner that when the current is first switched on, the resistance is all in and as the speed increases the governor gradually cuts out the resistance until all is out, the object undoubtedly being to produce as slight effect as possible on the lamps when the motor is first put on.

Absent. Mr. Edison in New York all afternoon returning in the evening.

Special Dynamo. Logan is winding a magnet for a special dynamo machine for lighting some establishment in New York, using much finer wire and about forty five pounds of it, the machine being intended to make its own field, hence the higher resistance of the coils around magnets.

Illumination. lit about 500 lamps at dark and burned till 8 o'clock at deflection of 173 on Galvanometer scale, being about five degrees higher than the usual burning. No tests were made of the engine, but the boilers furnished steam for the Brown, West, blower, and well digger engines

Visitors Morgan and others of the firm of Drexel Morgan & Co. a number of stock holders, and Cummings of the "Sun."

 Jany 6 - 81 -

Carbonization - Acheson is getting genl uniform and good results in metallic appearing carbons in tubes with gas from Petroleum products therein, at ~~low heat that is~~ high red heat, and is gradually loosing confidence in his theory that the dull black is due to low heat of carbons in the gas - see Jany 1.

Lamp experiments Mr. Edison wrote out some 9 or 10 experiments for Lawson to try in lamps at Factory. mostly the introduction of Phosphorus, Iodine etc. in the globe, to be acted on by the heat on pump or in use. List copied in Book No. 168 pages 9 etc.

Friday Jany. 7. 81

Papers. The "Sun" has a short article on the illumination here last evening, by "800" lamps from nine machines and that the "Phelps" Engine & dynamo is expected to furnish current for 1000 to 1200 Lamps.

Platinized carbons. The carbons Platinized by Lawson were put in lamps and exhausted, the resistance cold was from 520 ohms the lowest to 820 the highest but on heating in the vacuum the resistance was evidently very much lower than the regulars, as shown by the higher incandescence of them in same circuit with the regulars.

Economic test. Outside 383 lamps, inside 107 total 490 lamps were burned all night and Mr. Clarke took diagram cards from engine and had all coal carefully weighed. test not satisfactory in consequence of two additional engines taking steam part of the time and steam turned on in Laboratory, during the test

 Jany 7. 81

Armature. Mr. Edison gave Mott a sketch from which to make Patent Office drawings, of an armature, designed for powerful machines in which the bars are used (same as the Porter Allen dynamo) but the commutator is formed of discs arranged to connect the bars to the commutator blocks it is intended to be more easily and cheaply constructed than the one now being made for Porter Allen Dynamo but carrying out the same principles and efficiency.

Saturday Jany 8-81.

Experimental Lamps. Lamps with variously treated carbons and of different mechanical arrangements were completed and sent up from the Factory. they were tested by Francis ~~List~~ are not today arranged for trial of stability. One lamp with platinum wire coiled along and part of (say one fourth) the way up one side of loop. 2 lamps with platinum loops from same conductors, parallel with the carbon. 2 ~~the~~ half length carbons at right angles in series in one globe, one with a carbon broken in two clamped separately and standing parallel with one side of loop. one with condensers tested at 48c and 4, ½ lamps. carbons treated with petroleum, one with platinized loop and four treated with carbolic acid tested at 24c Book No. 186 page 1 etc.

Jany 8. 81

Lamp test } Regulars } Twenty-seven, 7 of which were Bach regular, Lamps, were started at forty eight candles this morning to be timed and their life at that incandescence determined during the day nearly 50% if failed
Book No 166. pg 71 &c.

Illumination In the early evening the lamps were started, but the large pulley on the counter shaft slipped and the engine was stopped to the disappointment a a number of sleighing parties who had driven here in pursuance of a false voluntary notice in the Tribune that a public exhibition was given every night and the public welcome to visit here

Visitors Welles & Dyer, also reporter of the Philada. Ledger.

Absent Mr Batchelor, also a large sleighing party in the evening.

Work general of past week. Well digging continued and not much water at 100 ft. Porter Engine received. Mr. Upton first went at the factory. Engine with coal test made by Mr Clarke. Acheson carboni...

Menlo Park Notebook #119 [N-80-09-27]

This notebook covers the period September-October 1880. Most of the entries are by Francis Jehl. There are also occasional entries by Francis Upton. Many of the entries are initialed by Edison. The book contains notes and tables of tests relating to the first lot of lamps (numbers 1-100), which was sent from the lamp factory to the laboratory for testing. There is also a copy of a note from Batchelor to Upton concerning these lamps and a list, prepared later, of lamps sent. The label on the front cover is marked "Factory," "Jehl," "Oct 1880," and "Lot 1 Lamps." There is an index on the inside front cover. The book contains 284 numbered pages.

Blank pages not filmed: 272-275, 280-281.

Index.

Sept 27 1880

Note from Mr Bachelor to Mr Upton) I sent 17 Lamps with nickel clamps of this pattern

the wires put through thin glass which is made concave at the point where the wires come out. I now send more and that makes

KM

17 with nickel
21 "
38

Also 9 with platinum clamps of which 6 bad viz — 1 Blue light
3 split in clamps
1 badly bent
1 high resistance

All these lamps are made from the fishing rod Bamboo cut previous to September 25th and are unpicked; so that we consider them poor and call them

((Fibres No 1)

sig
Bachelor

20 cell = 32

~~E M 7 20~~

E M 7 257

20) 3765 (188
176
160
165

5

E. M. 7. 250 - 250

Res. 37650
200

Can. 48

Battery = 32 - 32

Sept 27 1880

2.1673
2.1673
1.6164
7.7258
3.7068

5090

140 : 153 :: 159
2014
1847
8539
2400

174
159
+15

8983

140 : 153 :: 159 : a

$\frac{1}{a} = \frac{153 \times 159}{140}$

153
140
140

153 × 159

140 2.1461
2.1461
1.6464
159 7.7986
3.7372

5460

No 1

Cust	250^d R £ 250	~~139~~
Res	37650 ÷ 200	188 R
Candle	48	21 Res
Battery	20 cells = 32.-32	

1.8) 7500 (139
70
54
160
7

20) 3765 (188
20
176
160
165

2.1553
2.1553
1.6464
7.7645

3.7215 5260

No 2

Cut	242 - 243	1430 ~~4846~~
Bat	32 - 32	172 Res
Res	$\frac{31400 + 3000}{200}$	250 oh
		(34400
		17200
Cav	48	

31400
3000
20) 34400 (172
20
144
140
4

1.8) 2420 (134
18
62
54
80

2.1818
2.1818
1.6464
7.7258

3.7358 5440 ft. lbs.

No 3

Elu7	259 – 259152 ~~143~~	
Res	37650 / 200	188 Res 188.
Bat	32 – 32	14 ohms
Coul	48	

18) 2590 (143
18
79
72
70

14 W

20) 3765 (188
20
176
160
165
160

2.1367
2.1367
1.6464
7.8125

3.7323

5400

4

Emf 234 — 234

Rs $\frac{25150 + 5700}{200}$

Bat 32 - 32

emf 48

1370
154 ohms
23 ohms

57
308
154

$1.8)\underline{234}$ (130 Kai
18
54

25150
5700

20) 30850 (154
20
108
100
85

7) 238 (140
68

2.1421
2.1421
1.1464
7.7773
3.7159 5200

~~144~~

164 167

668

74 88 19

260

167

1.8

~~567~~

8153
1399
7799
7451
2549

180
166
+14

138 2.1399
2.1399
1.6464
166 7.7799
3.7061

5080

No 5

Amt	238 — 238
Bat	32 — 32
Res	~~27650~~ 31400 + 2000
	2000
Cand	48

140 ~~1320~~
167 Res
28 ohms

334
167

18) 2380 (132
18
58
54
40

31400
2000
20) 33400 (167
20
134
120
140

2.1875
2.1875
1.6464
7.7100
3.7314   5380

No 6

Cult	263 - 265 - 154 ~~146~~ V.	195 ohms
Res	$\frac{37650 + 1500}{200}$	120 ohm
Bat	32 — 32	
can	48	
	Blume	

376
15
391
195

TRG

1.8) 2630 (146
18
83
72
110
108

37650
1500
20) 39150 (195
20
191
180
115

2.1987
2.1987
1.6464
7.7258

3.7696

5880.

Ell	270 — 270	188 Res
Res	$\frac{37650+100}{200}$	158 v
Bat	32 — 32	7 ohms
Cand	48	$\frac{377}{188}$

37650 / 100

20) 3775 0 (188
20
177
160
170
160

1.8) 1700 (150
18
90

TA?

2·1931
2·1931
1·6464
~~7·7447~~
3·777[3]

5990

No 8

Elh	264 — 269	180 ohms
Res	$\frac{31400 + 4700}{200}$	156 ohms
		15 ohms
Cans	48	
Batt	33 — 32	

314
47
361
180

31400
4700
20)36100 (180
20
161
160
10

1·8)2640 (146
18
84
72
120
108
12

TKG

2.1931
2.1931
1.6464
7.7399
3.7725 5910

Eu7 266 - 264
Res $\frac{31400 + 5000}{2000}$
Cam 48
But 32 - 32

1560
1470
182 ohms

9 ohms

(364
1.82

3
18)2660 (147
18
86
72
140

$\frac{18}{4}$

31400
5000
20)36400 (182
20
164
160
4

2.1553
2.1553
1.6464
7.7496
3.7066 5090 ft

Alt	243 — 243	1435 / ~~1355~~
Res	$\frac{31400}{200} + 4200$	178 Res
Bat	32 — 32	26 oleg
Cond	48	

81
2
160

31400
42000
29)35600(178
20
156
140
160
160

314
42
356
178

2.1553
2.1553
1.6464
7.7520

3.7090   5120

No 11

Cut ~~256~~ ~~254~~ 243 – 243

Ro $\frac{31400 + 4000}{2000}$

~~Cut~~

Cand 48

Bat 32 – 32

1430
~~1350~~
177 Ro
25 ohms

354
177

31400
4000
20) 35400 (177

118) 2430 (13

1540
140

The?

2.1931
2.1931
1.6464
7.6799
3.6925

4920

No 12

EMH	266 - 266	1560 ~~1470~~
R	$\frac{37650 + 4200}{200}$	209 Res
		10 ohms
Bat	32 - 32.5	
Cond	4.8	

376
42
418
209

18)2660(147
18
86
72
140

TCE

18
144
18
7

1266 26
88
176

37650
4200
20)41850(209
185
180

2.1492
2.1492
1.6464
7.7375

3.6823   4210

No 183

CMF	~~252~~ 242 – 240
Res	31400 + 5200 / 200
Cand	48
Bur	32 – 32

1480
183 Res
29 Res

314
52
366
183

1,8) 2440
1540
64
54
70
54
16

(133

Tal

31400
5200
200) 36600 (183
20
166
160
60
60

7.1732
2.1732
116464
7.7100
3.7028

5040

No 14

E Mt
Rio
Mat
Card

269 – 2690
37650 + 1500
31 – 33 200
48

1580
195 Res
7 others

376
15
391
195

1.8) 2690
89
170
162
7

149
(149

37650
5000
20) 38650 (195
190
105

2.1644
2.1644
1.6464
7.7520
3.7272

5340

No ~~213~~/5

146~~0~~
~~1350~~
177 ohms
~~33~~R
21

EMF 250 - 250

Ohms $\frac{31400 + 4000}{20000}$

Bat 31, 33

Cur 48

$\frac{354}{.177}$

1.8) 2500 (138
18
70
54
160 7

31400
4000
20) 35400 (177
20
154
140
14

KAG

1.08
20
2.160
64

1.3345
1.8062
T.5283
2.6021
2.1364
2.1304
1.6444
7.7520
3.6592
.5185
.8593

$\frac{400}{64} \times 20 \times 1.08$

2.1367
2.1367
1.6444
7.7721
3.6919

135

31400
4000
35400

4590

4970 H.P. lbs

7.2 per H.P.

32) 200 (6.2
192
080

6164

314
40
2 | 354
177

33
32
3 | 65
22

200
200
3 | 400
133

254
6.2
508
1524
157.48

Emf 235 − 235 4970 H.P. lbs 1380
169 Res
Res ~~37650~~ − 314.00 + 2500
2.00
Bat 32 − 32
Cand 48 little Bene 33 ~~44~~ ohms

Emf 200 − 200
Bat 33 − 32
Res 31400 + 4000
2000
Cand 16

354
177

End of the first Cod of Lamps

177 157 4
157
1099
785
157
27649
4413
23947
98596
98596
109195.07

3
177) 109195.07 (6169
10624
299
177
1225
1062
1630

2·1523
2·1523
1·6464
7·7471
3·6981

4990

218
218
2 | 436
145

31400
4500
200 | 359 00
179

No 4

962 2.2095
2.2095
1·6464
202 7.6946
3.7600

5760

8153
2095
6946
7194
2806

191
1

No 17

Cand	16
Exit	~~218~~ — 218
Res	37650 + 3000 / 200
Batt	32 — 32
Obs	~~242~~ + 247
Res	31400 + 4500 / 200
Gird	48
Bat	32 — 32

142 ~~134~~0
179 Res
27 ~~40~~ ohms

1.8) 2420 (134
18
62
54
80

31400
4500
20) 35900 (179
20
159
140
190
180

3 | 424
1.41

212
212
3 | 424
1420) 3565 (193

37650
1000

186
180

3 | 212
70
140

2.1553
7.6904
3.5474

1.18
32
37.76

37650 4440 ft. lbs
3300
21.6) 38

1640
1522

21.6
1.18
1728
216
38.88

1.18) 41.20 (12

2 1.6
1.8
36.72

243
245
3 | 488
162 163

EM7	212 - 212	~~1350~~ 190 ohms
Res	37650 + 1000	
Bat	32 - 2000/32	
Cond	16	
		1435 ~~1350~~
EM7	243 - 245	204 ohms
Res	37650 + 3300	
Bat	32 - 2000/32	~~43~~ ohms 29
Cond	48	

Up to this Camp they were all tested with the old battery, the 32 def is to be multiplied by 1.18

37650
1000

2.1644
2.1644
1.6464
7.7471
3.7223   5280

19   Sept 30th

E.M.F	~~205 - 205~~ 185 - 185	
Res	37650 + ~~1500~~ / 200	188 Res
Bat	32 - 33	1230
C	16	~~46~~ ohms
E.M.F	219 - 219	
Res	31400 + 4500 / 200	6½ / 122
Bat	32 - 32	1460
Cur	48	179 R
		22 ohms

20) 3765 0 (188
2000
176
160
165
160

2.1875
2.1875
7.6968
1.6464
3.7182 .5230

2.1239
2.1239

200
198
2 | 398
199

37650
4900
| 42550 | 212
40xxx
255
2800
550
490

Em	232 – 232	201 Res
Res	37650 + 2700 / 200	154 v
		13 Res
Cau	48	
Bat	32 – 33	
Aut	200 – 198	200 / 198 / 398 / 132
Res	37650 + 4900 / 200	376.5 / 49 / 425.5 / 212
C	16	
Bat	33 – 32	

Alop for to tail rome lines.

37650
2700
40350

37650
2700
20 | 40350 | 201
3 | 232
77
154

2467	260 — to high
Bat	32 — 32
Res	$\frac{37600 + 120000 + X}{200}$
Can	16 ~~4~~ ca

This is all I could get on it. On one of the clamps there was that peculiar phosphorescence.

$$\begin{array}{r} 260 \\ 3\overline{)520} \\ 173 \end{array} \quad \cdot 2 \quad v$$

2.1461
2.1461
1.6464
7.7747
3.7133 5170

210
213
3)423
141

31400
2300
200)33700
168

179
182
3)361
120

C	48	1400 168 Res
Res	$\frac{31400 + 2300}{200}$	
E.Wt	210 — 213	28 R
Bat	32 — 33	
	Blue	TLR
C	16	
E.Wt	179 — 182	
Res	$\frac{31400 + 4600}{200}$	
Bat	31 — 33	

31400
2300
20)33700 (168
20
137
120
170
160
3)212
72
140

2.1461
2.1461
1.1646
7.7645

3.7031 5050

E.7M	210 – 214	1400 172 Res
Res	$\frac{31400 + 3100}{200}$	
Bat	30.5, 33	29 Res
@	48	
EM7	180 –	
Res	$\frac{31400 + 45000}{2000}$	
Bat	30.5 – 33	
@	16	

31400
3100
20 | 34500 (172 Res
1,45

3 | 212
70
2
140

2.2041
2.2041
1.6464
7.6216
3.6762

4750 ft. lbs

24

C	48	1600
CMF	240 243	239 Res
Res	$\frac{37650 + 10200}{200}$	5 (others)
Bat	30.5. 33 Blue	
CMF	200 —	TR 9
Res	$\frac{37650 + 12000}{200}$	
Bat		
C	16	

80
2
160

37650
10200
20) 47850 (239
68
185

2,1523
2.1523
1,6464
7.8013
3.7523 5650

182
183
2 | 365
182

314
45
2 | 359
179 - 180

E M F	215 - 214	1420
Res	31400 + 300 / 200	158 Res
Bat	30 - 33	24 Res
C	48	
	Sure shunt Tel	
Res	31400 + 4500 / 200	314 / 45 / 2 | 359 / 179.5
C	1.60	
Curt	182 - 183	182 / 183 / 3 | 365 / 122 Volts
Bat	30 - 33	

31400
300
20 | 31700 (158.
20
117
160 | 71/2 / 142

2.1875
2.1875
116464
7.7190
3.7404

37650
 6200
200) 43850 (219
198
198
3) 396
132

C	48
R	$\frac{37650 + 700}{200}$
Emf	232 – 232
Bat	33 – 30
	Blue and mercury in glob

154.0
191 Res
5500 ft. lbs.
12 ohms

C	16
R	$\frac{37650 + 6200}{200}$
E.mf	198 – 198
Ba	34 – 30

37650
 6200
43850
219.25

198
198
3) 396
132

37650
 700
200) 38350 (191.
200
183
180
35

3) 232
77
154

had a very bad
spat and gave
away at about
one Claudee,

[initials]

a very bad spot
on the top of the
loop. gave away
~~the~~ some Hg was
in the globe

TAE

2.1523
2.1523
1.6464
7.7747

3.7257   5320

29

C	48	1420 168R
Res	$\frac{3.1400 + 2300}{200}$	
E. M. F.	212 — 213	26 ohms
Bat	33 — 32	
E. M. F.	180 — 180	314 40 354 177
Res	$\frac{31400 + 4000}{200}$	
C	16	180 180 360 120
Bat	305 — 33	

31400
2300
20) 33700 (166
20
137
120
170   7½ 1½

2.1523
2.1523
1.6464
7.8013
3.7523 5658

Rs	31400 + 200	142 v
E.M.F.	213 200 212	158 Rs
C	48	24 ohms
Bat	31 – 32 Rlue at one of the clamps	
C	16	
E.M.F.	~~190~~ – 190	190
Rs	31400 + 1700	310
Bat	33 200	

31400
200
20)31600(158

3)212
71
142

2.1875
2,1875
1,6464
7.6757

3.6971 4980

232
234
3 | 466
1553

3765
690
20 | 4455
228

Res	$\frac{37650 + 4700}{200}$	1540 211 R
EMF	232 — 234	
Bat	32 - 30,5	13 ohms
C	48 Blue in clamps	
C	16 TKE	376. 69 445 222
Res	$\frac{37650 + 6900}{200}$	
Bat	32 — 32	
EMF	215 - 215	215 215 430 143

37650
4700
20) 42350 (211 R
40
23
3 | 233
77
154

2.2041
2.2041
1.6464
7.7077
3.7623

5780 ft. lbs

Res	$\frac{37650 + 1600}{200}$ 1600
EMF	240 – 241 196 Res
C	48 4 ohms
Bat	32 – 33 Blue in Clamp
Res	$\frac{37650 + 3500}{200}$ 376. 35 411 205
EMF	210 – 212 [illegible] 210 212 422 141
C	16
Bat	32 – 33 Blue in Clamp

37650
1600
20)39250(196
20
192
160
120
120

80
2
160

2.2095
2.2095
1.6464
7.6326
3.6980 4990

37650
1190
2 | 358 40
194

201
206
3 | 407
1-35 136

Rio	$\frac{37650 + 9000}{200}$	233 Rio
C	48	162 v
E.M.+	240 — 247	2 (olimp)
C	16	3765
Rut	$\frac{37650 + 11900}{200}$	11.9 / 3884 / 194
E.M.+	201 — 206	206 / 201 / 407 / 136

37650
9000
20) 46650 (233
40
66
60

49
47
2) 84
43

3) 243
81
162

2.1703
2.1703
1.6464
7.7235

3.7105

5130

189
190
379

3 | 379
126

37650
1700
200 | 39350 | 196
20
193
180
135
120
15

Res	$\frac{37650 + 300}{200}$	1480 189 Res
Emf	220 — 224	20 ohms
C	48	
C	16	
Res	$\frac{37650 + 1700}{200}$	
EMF	189 — 190	

37650
300
20 | 37950 | 189.
20
179
160
195
180
5

3)222
74
148

2.2148
2.2148
.16464
7.6517
3.7277

5340

232

157

37650
8800
232

Res	$\frac{37650 + 7000}{200}$	164 C 223 Res
C	27	Nothing
E. M F	245 — 251	
	Blue at cathode Hg in globe	
Em F	232 — 239.	
Res	$\frac{37650 + 8800}{200}$	FRG.
C	16	

37650
7000
200) 44650 (223

3 (248
164

2.1584
2.1584
1.6464
7.7375
3.7007

5020

aten
143 2.1553
2.1553
1.6464
182 7.7399
3.6969

4970

8153
1553
7399
7105

2895

195
182
713

Res	$\frac{31400 + 5300}{200}$ 0144 Res 183
Out	213 – 217
@	48 Blue in glob 32 Res
Res	$\frac{31400 + 7000}{200}$
Out	172 – 179
@	16

31400
5300
36700 183 Res
18
70

213
217
2)430
3)215
72
144

3)224
7.4
14.8

31400
5700
20)37400(1850
186
110

2.1703
2.1703
1.6464
7.7328
7.7198

5250 J.H.U.

37

Res	$\frac{31400 + 5700}{2000}$ 1480 185 Res
C	48
EMF	222 - 226 20 ohms ~~Alter~~ Blue at the clamp
EMF	193 - 195 JWG
Res	$\frac{37650 + 6000}{2000}$
C	16

31400
4000
200) 35400
177

31400
5100
200) 36500
182

2.1072
2.1072
1.6464
7.7520
3.6128 4100

2.1139
2.1139
1.6464
7.7520
6262 4230

38

Res	$\frac{31400 + 4000}{2000} = 177$ ohms
Emf	193 – 198
C	48 49 ohms
Emf	182 – 179
Res	$\frac{31400 + 5100}{200} = 182$ ohms
C	1.6 9.4 per horsepower

182
4
728

1200
120
2400
120
14400

182) 919 (6

3505) 33000 (9.4
31545
14550
14020

182) 637920.0 (3505
546
919
918

9.4 per

31400
3000
200)34400 (172

31400
3900
200)35300 (176

227
231
2)458
3)229
76
152
152
304
760
152
23104
443
69312
92416
92416

172)1023507.2 (5950.
860
1635
1548
870
860

595 × 4 = 2380
595 × 5 = 2975

5950)33000 (5.5
29750
3250

3)228
76
172
76
1548

Res	$\frac{31400 + 3000}{200} = 172$ ohms
	17
EMF	227 — 231 5.5 per HP
C	48 TAG 1520 172 ohms
	Blue in globe and Hg in also 13 ohms
Res	$\frac{31400 + 3900}{200} = 176$ ohms
C	16
E.M.F	E 203 — 207
	Blue at Clamp.
Bat	31 — 33

136
136
816
408
136
18496
44.3
55488

3)205
68
136

3 1 4 0 0
1 3 0 0
20) 3 2 7 0 0
127
126
70
60

163

2
3) 203
67
134

2.1271
2.1271
1.6464
7.7877
3.6883

4880

129 2 1106
2 1106
166 1.6464
7.8069
3.6745

4720

8153
1106
8069
7328
2672

185
156
+29

40 Oct. 1. 80

Res	$\frac{31400 + 1300}{2000}$ 1340 163 Res
EMF	203 — 204
C	48 36 ohms
Bat	325–325
C	116
Res	$\frac{31400 + 2700}{2000}$
EMF	170 – 169

37650
4100
20)41750 (208 Res

3)224
74
148

2.1703
2.1703
.16464
7.6819
3.6689 4660

41

C	48 1480 208 Res
Res	37650 + 4100 / 200
E.M.T.	224 – 223 22 Res
	Blue
Res	37650 + 6700 / 200
C	16
E.M.T.	194 – 193

3 | 223
74
148

37650
800
20) 38450 (192
20
184
180

2.1614
2.1614
1.6464
7.7167
3.6859

4850

42

Res	$\frac{37650 + 800}{200}$	1480 / 192 Res
Emf	223 – 222	20 Res
C	48	
Emf	190 – 189	
Res	$\frac{37650 + 2900}{200}$	
C	16	

3/. 209
69
2
1380

31400
2900
20)3430 (171
20
143
140
0

2.1399
2.1399
1.6464
7.7670
3.6932 4930

150 2.1761	8153
2.1761	1761
1.6464	.7496
7.7496	7410
178: 3.7482	2590
5600	+1

179
~~178~~

43

	Hg in glob 1380 171 Res
EMF	209 — 209
	32 Res
R	$\frac{31400 + 29000}{2000}$
C	48

C	16
EMF	150 - 179
R	$\frac{31400 + 47000}{2000}$

3) 234
78
2
156

37650
2900
70) 40550 (202
5

2.1931
2.1931
1.6464
7.6946
3.7272   5340

44

C	48 Res 202 V 156
EM	7 234 – 235 9 clms
Res	37650 + 2900 200 Blue at Clamps
C	16 TAE
Res	37650 + 5800
EM7	208 – 207

37650
4900
20) 42550 (212 R
40
25
55

3 (213
71
144

2.1584
2.1584
1.1646 4
7.6737
3.6369 4320

160 2.2041
2.2041
1.6464
2.147.6696
3.7242

5300

845
7041
6646
6896
3110

45

Res	$\frac{37650 + 4900}{1000}$
Elut	213 — 1213
C	48
C	16
Elut	182 — 183
R	$\frac{31400 + 7900}{200}$

Res 212
V 144
29 Res

71
142 ✓

31400
4000
20)35400 (177

177)893260 (5046
885

8826
708

1180

177
4
708

177
6
1062

3/1180
60
120 ✓

160)637920 (3987
480
1579
1440
1392
1280
1120

46

Emf	213 – 212	1420, 177 R, 5046 fills
Res	$\frac{31400 + 4000}{200}$	280 ohms
C	48	
C	16	120 V, 160 Res, 3987 fl lbs
Emf	180 – 187.4	
Res	$\frac{31400 + 6000}{200}$	

31400
6000
20)37400 (160 R
120
120

31400
2800
20)34200(171
20
142
140
20

3/211
70
140 v

171
1565

171
855

171)868280(5077
855
1320
1197
1310

176

171
1368 5

3)180
60
2
120 v

180
4
720

31400
4700
20)36100(180
20
161
160
10

180)637920(3544
540
979
900
792
720
720

180
6
80

135	21303
	21303
	1.6664
166	7.7799
	3.6869
	4660

188
166
22
+

8153
1303
7799
7155
2745

Ro	$\frac{31400+2800}{200}$	Res 171 v 140 ftlbs 5077
C	48	
Ent	211 – 212 TAE	29R
C	16	120 v 180 R 3544 ftlbs
Ent	180 – 179	
R	$\frac{31400+4700}{200}$	

3/214

71

2

1420

163

6

984

$16 - \frac{163}{9}$

67

31400
1200

20) 33 4 0 0 (163
126
120
60

163) 893260 (5480
815
782
652
1306
1304
2

3/179

60

2

1200

168

4

672

168

168

1176

168

9

1344

126

168) 637920 (3797
504
1339
1176
1632
1512
1200

48

Ent	214 — 213	1420 163 Res 5480 ft lbs
Res	$\frac{31400 + 1200}{200}$	
Can	48	25 R
Ent	179 — 180	1200 Res 168 3797 ft lbs
C	16	
Res	$\frac{31400 + 2300}{200}$	

31400
2300
20) 33700 (168
133
170

3/261
87
174 ✓

37650
5000
20) 42650 (213
40
26
213) 1341230 (6296
1278
632
426
2062
1917
1460
1278

2.2405
2.2405
11.6464
7.6716
3.7996 6300

3/229
76
152 ✓) 1023500

232) 1023500 (4411
928
0955
928
270
232
380

.49

ENT	260—262	174 ✓ 213 Rs 6296 ft lbs
R.	$\frac{37650 + 5000}{2000}$	nothing
C	48 Blue at Clamp	
Rs	$\frac{37650 + 8800}{2000}$	
Emt	2 ~~28~~ 228—230	~~K~~ KE
C	16	

152 ✓
232 R
4411 ft lbs

37650
8800
20) 46450 (2324
40
64
60
45

3 | 237
79
158

37650
3700
20)41350(206
135

206)1105950(5457
1030
757
824
1152
1072
1420
1442

3 | 213
71
142 V

37650
5000
20)42650(2
42
265

213)893240(4193
852
412
213
1994
1917
770

EMT	237 – 238	158 V
R.	37650 + 3700 / 200	206 R 5457 ft lbs 7 ohms
C	45 Blue at Clamp	
C	16 TKG	142 V 213 Res 4193. ft lbs
Emt	213 – 214	
Res	37650 + 5000 / 200	

3)219
73
1460

314000
46000
20)360000
18000

944300

3)189
63
126

161
644

37650
800
20)38450 (192
20
122
120
20

182)78331 (436
644
593
463
1601
966
1350
1266
62

1288

51

Emt	219 — 220	1460 180 Res 5246 ft lbs
Res	314000 + 46000 / 2000	22R
@	48	4Re
Emt	189 - 190	1260 192 Res 3663 ft lbs
Res	37650 + 800 / 2000	
@	16	

5 2

EM7	221 – 222
R	$\frac{31400 + 3700}{2000}$
e	48

TKE

E. MT	189 – 192
Res.	$\frac{31400 + 5900}{2000}$
e	16

3)254
84
2
1680
192) 1251210

31400
7100
20) 38550 (192
20
185
180
50

3)230
77
2
1540

20) 105,462 (5253
98
105
100
62
60
2

52

Emf	254 - 255 1680
	192 Res
Res	$\frac{31400 + 7100}{200}$ 6516 ft lbs
C	48 Blue at clamp molting
EMF	2305 230 1540
	200 Res
Res	$\frac{31400 + 8700}{200}$ 5253 ft lbs
C	16 Blue at clamp.

31400
8700
20) 40100
200

19

3/229
76
2
1520

31400
5000
20/36400 (182
20
164
160
40

1023500

19
1

2.1818
2.1818
1.6464
7.7399
37499 5700

3/193
64
2
1280

37650
900
20)38550 (192
20
185
180
55

192
768

10
6 10
192) 7 5 8 1 0 (3780
576
1498
1344
154
1536
5

193
1344

53 T

E.M.F.	229 — 230.5 1520 182 Res 5623 ft lbs
Res	31400 + 5000 / 200 14 ohms
C	48
	Hg in this globe
C	16 1280 192 Res
Res	37650 + 900 / 200 3780 ft lbs
E.M.F.	192 - 195

$\frac{3\,2\,8\,5}{9}$

54 T.R.G.

C	33 to light Ras
Best	$\frac{37450 + 120000 + x}{2000}$
E.M.7	285 — 286
Em7	256 — 258
C	16
R	$\frac{3765 + 120000 + x}{2000}$

82
2
1640

37650
2000
20) 39650 (19..
20
196
180
165
160

198) 1191480

3/215
72
1440

37650
3600
20) 41250 (20..
40
125
120

206) 918690 (4459
824
946
824
1220
1030
1900

55 [illegible]

C	48 0164 Res 198
E.Mt.	247 – 249 fllbs 6017
R	$\frac{37650 + 2000}{200}$ nothing [illegible]
EMT	214 – 216 1440 206 Res
R	$\frac{37650 + 3600}{200}$ 4459 fllbs
C	16

80
2
1600

.37650
2600
20) 40250
201

201) 1134080

70
2
140

37650
4800
20) 42450 (212
40
30
45

212) 868280

56 Tee

E.M.F	240 — 242 1600 Res 201 Ohms 5842
R	37650 + 2600 / 500 5 ohms
C	48 Little Blue
E.M.F	245 – 209 140 Res 212 Ohms 4095
R	37650 + 480 / 200
C	16

3)246
82
164

20)37650 176
188 ohm

188)1191480(

200 R.

76
2
140

200)868280(4341
80
68
60
82
80
28

57 4 Vg

E.M 7	244 - 248 — 164 v, Rs 188, ohms 6348
R	$\frac{37650}{200}$ — nothing
C	48 Blue at clamp 0
E M 7	210 — 211
Rs	$\frac{37650 + 2400}{200}$
Cl	16

37650
2400
20)40050(200
40
005

140 v
200 Rs
ohms 4341

Hg in this globe
when Current was
put it went up, there
must have been a
very bad vacuum

5

$\frac{74}{2}$
1480

3 7650
1300
20)38950(194
180
150
95

970350

62^2 2202
67

$\frac{67}{2}$
1340

37650
3500
20)41150(205

795450

59 Tal

Hg in Therglob

e.m.f.	222 — 1480 Res 194 Albo 5001
Res	$\frac{37650 + 1300}{200}$ 20 ohms
θ	46 Blue at clamp
Emf	201 — 204 1340 Res 205
R	$\frac{37650 - 3500}{200}$ fllbs 3880.
C	16

83
2
1660

37650
5200
20) 42850 (21

214) 1221170 (5706
1070
1511
1498
1370
2 24
4

3/207
69
2
1380

37650
8200
20) 45850 (229

229) 843650 (3683
687
1566
1374
1925
1832
930

60 Oct 2 1880

E.Nt	249 — 250 166 Res 214 plbs 5706
Res	$\frac{37650 + 5200}{20}$ nothing
C	48 Blue in Cloud
E.Nt	208 — 210 138 Res 229 plbs 3683
Res	37650 + 8200
C	16

2

78 179 31400
2 6 4400
156 1074 2435800 (179
15.8

179)1078090 (6022
1074
409
358
25
510
137

3)205
68
136 ✓

194 : 819370 180 2

191) 819370 (4289 $\frac{191}{573}$
764
553
382
1717
1528
1890
1719

31400
6900
20)38200
191

191 7
9
1528

191
9
1719

61 Tph

EmT 236 – 237 ν 156 Res 179 ft lbs 6022

R $\frac{31400 + 4400}{200}$ 15R

C 48 Blue at Clamp

C 16 ν 136 Res 191 ft lbs 4289

EmT 204 – 206

R $\frac{31400 + 6900}{200}$ Blue at Clamp

79
2
158 U

1105950

37650
4900
20) 42550 (212
40
25
20
55

212) 1105950 (5216
1060
459
424
355
212
1430
1272

223) 870350 (4351
892
783
669
1145
1115
300

222
226
58
8
244
74
148 U

37650
7000
20) 44650 (222 R
40
46
40
65
60
5

62

Oct 2 1886

Tar

C	86	U. 158 Res 212
Res	37650 + 4 ~~fflbs~~ 5216 / 2000	8 olums
E M.F	239 – 240	
Bat	33 — 31.5	Blue at clamp
E M F	222.5 – 226	148 U 223 Res 4351 ff lbs
Res	37650 + 7000 / 2000	
C	16	Blue at clamp

72
2
142 ✓

181
05

181
9
1629

31400
4400
20)36330 (181
20
163
163
3

181
4
24

181)893260 (4935
724
1692
1629
636
543
930
905

179
182
2)361
180

189
56

37650
300
20)37950 (189

60
2
120 ✓

189
32

189)637920 (3375
567
709
567
1422
1323
990
945

Tky ~~63~~ same lamp as no 9

E. M. F.	212 — 212 ✓142 Res 181 ft 4935
Res	$\frac{31400 + 4900}{200}$ 28 R
C	48
E. M. F.	179 — 182 120 ✓ Res 189 ft lbs 3375
Res	37650 + 300
C	16

3) 225
75
2
150

20) 38250 (191
37650
600
20
182
180
2

191
37
1528

191) 996750 (5218
955
417
382
355
191
1640
1528
12

62
2
124 ✓

205) 681160 (3322
615
661
615
466
410
560

20) 41150 (205
37650
3500
40
115

63 July

Em 7	224 — 226	150 w
Res	$\frac{37650 + 6}{2000}$	Res 191 / lb 5218 / 17 R
C	4.8	
Em 7	185 — 187	1240 / 205 Res / 3322 lbs
C	16	
Res	$\frac{37650 + 3500}{2000}$	

241 37650
9000
20) 4665 (233
233) 1134080 (4867
2097
2020
1864
233
6
1398
1566
1398
1700
1631
3/225
75
150 ✓
37650
9700
20) 47350 (23
2436
236) 996750 (22
1247
236) 996750 (4223.
527
472
555
472
830
708

Res 37650 + 9000 / 200 ∪ 160
Res 233
Ext. 240 – 242 plbs 4867
nothing.
C 24. Blue in Clamps

Ext 224 — 226 ∪ 150
Res 236
Res 37650 + 9700 / 2000 plbs 4223.
C 16 Blue in clamps

3) 214 (71
142 (143

168 × 3 = 504

2) 31400
22000

20) 33600 (168 R

168) 893260 (5317
840
532
504
286
168
1180
1176

168 × 7 = 1176

57 × 2 = 114 ✓

31400
4200

20) 35600 (178

160) 575720 (3
480
957

178) 575720 (3234.
534
417
356
612
534
780
712

534
178
12

Res	210 - 213	v 142 Res 168 ff 5317
Ew	31400 + 22000 / 2000	25 R
@	48 Blue in globe	
Elect	172 - 172	v 114 R 178
Rest	31400 + 42 oft lb / 200	3234.
@	16	

198
1782

198R 37650
2000
20) 39650 (198
196
160

198) 1078090 (5448
990
888
792
969
792
1770
1584

232
237
2)469
3)234
78
156 V

2211

70
140 V

37650
4900
20)42550
212 Res

R
212) 868240 |4095.
848
2024
1908
1200

64 Tee

C	48	V 156
Res	37650 + 2000 / 2000	Res 198 lbs 5448.
EM7	232 — 237	10R
	Blue in Clamps	
Em7	210 - 212	V 140
C	16	Res 212 wrought at 16C lbs 4095.
Re	37650 + 4900 / 200	Blue in Clamp

3)228
76
2
152 ✓

37650
3800
20)41450

207) 102350 (4944
828
1955
1863
920
828

126
7.4
82

6 126
8
1008

4920
63
2
126 ✓

126) 703310 (5581
630

733
630
1031
1008

37650
5800
23020 20)43450
217

217) 703310 (3
434
2693

217) 703310 (3241
651
523
434
884

230

67 Tak

E. M7	223 — 225 v 152 Res 207
Res	$\frac{37650 + 3800}{200}$ of lbs 4944.
	16 R
C	48
E. M7	184 — 188 v 126 Res 217
Res	$\frac{37650 + 5800}{200}$ of lbs 3241.
C	16

81
2
162 V

37650
5800
20) 43450
217

R 217) 1162610 (5357
1085
776
651
1250
1085
1650
1519

75
2
150 V

223) 996750 (4469
892
1047
892
1555
1338
2170
2007

Blue in Clamps

EM7	242 – 245 V 162 Res 217
C	24 ftlbs 5357
Res	37650 + 5800 / 200 2 ohms
EM7	225 – 226 V 150 Res 223
Res	37650 + 7000 / 200 ftlbs 4469.
C	16 Blue in Clamps

37650
7000
20) 44650
223 R

72
2
144 ✓

144
2
264

~~144) 918600 (6379~~
~~864~~

546
432
1140
1008
1320
1296

194
2
46

194
70

37650
1200
20) 38850 (194
20
188
180
85

194) 918600 (4735
776
1426
1358
680
582
980
970

6½
122 ✓

208) 659360 (3121
624
353
208
456
416
400

69 Tug

Em7	2215 – 216 ✓144 Res 194
Res	37650 + 1200 / 200 4735 ftlbs 26 R
C	48 Blue cir flob
Em7	183 – 184 ✓122 Res 208
Res	37650 + 4000 / 200 ft. 3121
C	16

37650
4000
20) 41650 (208
40
165
160

224
228
2452
3)226
75
150 √

37650
2600
20)40250(201

201)995750(4959
804
1917
1809
1185
1005
1800
1809

3)156
62
124 √

214)678468(3183.
642
381
214
1776
1712
640

70 TAE

E.M.F	228 – 224	√150 Res 201
Res	$\frac{37650+2600}{200}$	ohms 4959. 18 R
C	48	
	Bene in glob	
Res	$\frac{37650+5200}{200}$	
Emf	187 – 185	
C	16	

37650
5200
20)42850(214
40
28

√124
Res 214
ohms 3183.

72 169 3 314-0 169
476 250-0 6 4 5
144 200)33900(
169) 91860 (5435 169 ohms
845
736
676
600
507
930
845

175 2144
350 60
120

175) 637929 (3645 175
525 6
1129 1050 .3
1050
792
700
9200
8750
45

71 Tek

Emit 215 - 216 v 144
Res 169
Res 31400 + 2500 of lbs 5435
200 23R
C 48

E.Mit 180 - 182 v 120
Res 175 ohm
Res 31400 + 3700 3645 ft lbs
200
C 16

31400
3700
200)35100
175 Ohms

75
15·0

37650
2500
20) 40150 (200
40

200) 996750 (4983.1
800
196
180
167
160
75

190
187
377
3) 188
63
2
126

70

211) 703310 (3333.
633
703
633
701
633
680

72 Tak

En7	226 − 225	v 150 Res 200
Res	$\frac{37650 + 2500}{200}$	ftlbs 4983. ∴ 18 R
C	48 Blue in flat	
En7	190 − 187	
C	16	
Res	$\frac{37650 + 4700}{200}$	

37650
4700
20) 42350 (211
40
23
35

v 126
Res 211
ftlbs 3333.

$\frac{81}{2}$ 155 / 162 — 231 / 86

1162610 / 1155 / 00761 / 693 / 680

231) 1162610 (5033
924
2386
1386

194 / 73 / 146 / 58

144 / 1364 — 194 / 82 — 01 3 — 194 / 702 — 194 / 1258

194) 944300 (4867
776
1683
1552
1310
1164
1460
1358
102

$\frac{81}{16}$ 73 Tlek

Em7	243 1243	v 162 Reg 231 ft lbs ~~4600~~ 5033
C	33	
Res	$\frac{36650 + 9700}{200}$	nothing
Em7	219 − 21	
Res	$\frac{37650 + 1200}{200}$	
C	1.6	

36650
9700
20) 46350 (2317
40
63
60

v 146 Reg 194 ohms ft 4867.

37650
1200
20) 38850 (194
20
188
180
85

3(233
77
154

37650
2500
20) 40150 (200
40
15

200) 1050620 (5253
100
50
40
106
100
62
60
2

3(195
65
130

211) 748670 (3547.
633
1155
1055
1007
844
1630
1477

154 | 164 | 200 | 200+4
200
154) 32800 (212
308
200
154
460
62

74 Tee

Emt	233 – 233 V 154 Res 200
Res	37650 + 2500 / 200 ffllbs 5253. 12R
C	4.8 Blue in globs
Emt	195 – 196
Res	37650 + 4700 / 200
C	16

V 130
Res 211

37650
4700
20) 42350 (21 ffllbs 3547,
28
35
20
150

67
2
134

31400
1000
20) 32400 (
162

17956
448
162

162) 795450 (4910.

169) 575720 (B

169) 575720 (3405.

142 2.1523
2.1523
1.6464
164 7.7852
3.7362

5450

8153
1523
7852
7528
2472

177
164
13

75 [illegible]

Em7 200 − 200 1340
Res 162.
Res $\frac{31400 + 1000}{200}$ ftlbs 4910.
38R
C 48 [illegible]

[illegible] 172. − 174
Res $\frac{31400 + 2000}{2000}$
C 16 C

0114
Res 169
31400
2500
200) 33900 (ftlbs 3405.
169

134 : 164 :: 162 :: 162 + x
162
164
648
972
162
134) 26568 (197

197
162
35

226
228
2454
3|227
75
150
150
7500
150
22500
443
67500
90000
199)99675.00(5008. ft lbs
1200
1592
108

199
4
995
1998
91
199
8
1592

3)191
63
2
126

15876
443
47628
63504
63504
215)7033960(32.71.
583
430
1530
1505
256

76

EM7 226 − 228 = 150
Res 199
Res 32000 + 36650 ft lbs 5008.
200
Cam 48
14R
32000
36650
20)38850(199.
198
180
185
180
1260
Res 215
ft lbs 3271

EM7 190 − 192
Res 5500 + 37650
200
C 16
37650
5500
20)43150(2
...
115

150 : 1464 :: 199 − 199 + 4
164
796
1194
199
150)32636(213
300
203
150
536
450

213
199
14

Oct 4 1880

Note from Mr Batchelor

Received from factory

Set 25	– 2 lamps		2.1644
28	47	..	2.1644
29	30	..	1.6464
30	30	..	7.7055
			3.6867
Oct 4	30	..	
	139 lamps		4800

all that could be counted up at this date was 134 lamps

J.U.

20 more came up.

146 1.1641 : 197 : 197+x

164
788
1182
197
146)32308(221
292
310
292
188

221
197
24

77 Oct 4 Tek

Bat 32 33 1460

Em 219 – 219 197 Res

Res 37650 + 1800 24 R

2000

C 48 Blue in glass

EM 187 – 187

Res 37650 + 4000

2000

C 16

73
2
146

37650
1500
[illegible]
[illegible]
194
146
145

3)216
72
144

37650
6000
20)38250
191
182
25

2.1584
2.1584
116.464
7.7190
36822

4810

78

EM7 216 – 217
Res 37650 + 600
C 48

1440
191 Res
26 R
Little Blue

EM7 180 – 180
Res 37650 + 2300
2000
C 16

144 1164 191 1914
164
764
1146
191
144)38324 (217
288
2952
144
1080
1088
322

217
191
26

3) 235
78
2
156

37650
4500
20) 42150 10
40
21
20

2.1931
2.1931
1.6464
7.6776
37.104 57.30

79 Tick

Ent 235 - 235 156 U
210 Res

Res 37650 + 4500 10 R
2000

C 4.8

Ent 200 - 200

Res 37650 + 6900
2000

C 16

156 : 164 :: 210 : 210+2
164
210
1640
328
156) 34440 (220
312 210
324 10
312
120

72
2
144

314000
15000
20)36400 : 182
60
40

36

164 2.2148
182 21 2601
amp 144 7.8416
2.3165

207
182
25

2.1492
2.1492
1 16464
717399
3.6847

4840

EM7	215 215
Res	$3\frac{1400+5000}{2000}$
C	48

144 0
182 Res
18 ohms

EMF	176 − 176
Res	$\frac{3.1400 + 7100}{2000}$
C	48

144 : 164 :: 132 : 132 + X

132
164
528
792
132

144)21648(150
144
724
720
48

132
18

144
76

73
.2
146

37650
2000
70/39650
2.04...
196
...

2.1644
2.1644
1.6464
7.7053
3.6785

4770

81

EM7 218 — 218 146
Res 37650 + 2000 Res 198
2000 24R
C 48

EM7 190 — 190
Res 37650 + 2900
2000
C 16

146 : 164 :: 198 :: 198 + x
164
792
1188
198
146) 32472 (222
292
327
292
355
292

198
24

82
2
164

3

82 TAE Tar

Hg in Flas glob

Em-7 245 - 245 too high

Res 37650 + 12000 + 4
2000

C 65,25 inches

Em-7 217 - 217

Res 37650 + 12000 x
2000

C 16

3)250
83
2
166

3

83 128

Blue on clamp.
leaning on one side to high

E.M7 250 - 250.

Res $\frac{37650 + 12000 + x}{2000}$

C 23.5

Em7 240 - 240

Res $\frac{37650 + 12000 + x}{2000}$

C 1.6

2

3 | 205
68
136

3 | 400
24) 334 0 0 | 167
28
137
120
140

2.1335
2.1335
1.6464
7.7773
3.6907 4900

84 [illegible]

E.M.F.	208 — 208	136
Res	$\frac{2000 + 31400}{200}$	167 Res
		34 R
C	48	

Hg in glob and very blue

E.M.F.	172 — 172
Res	$\frac{31400 + 3500}{200}$
C	16

136 : 164 :: 167 : 167+4
164
668
1002
167
136) 27388 (201
272
188

201
167
.34

2

3) 208
69
138 0

31400
2200
20) 3360
136
160
160

2.1399
2.1399
1.6464
7.7747
3.7089

5030

85 KOE

ENA 208 - 208

1380
168 Res
31 ohms

Res $\frac{31400 + 2200}{200}$

C 48

ENA 175 - 175

Res $\frac{31400 + 3700}{200}$

C 16

138 : 164 :: 168 : 168 + x

164
672
1008
168
138) 27552 (199
138
1375
1242
1332
1242
90

199
168
31

138
9
1242

3/207 2

69
2
138

31400
4400
20)35800
...
158
...
18

2.1399
2.1399
1.6464
7.7479
3.6741 4720

8153

155 2.1903
2.1903
1.6464
167 7.7282
3.7552

5690

86

EM7	207-207	1380
Res.	31400 + 4400	179 Res
	200	33R
C	48 bluem...	
EM7	176 - 176	
	31400 + 6000	
	200	
C	16	

138 : 164 :: 179 : 179 + X
164
716
1074
179
138)29356 (212
276
175
138
376
276

110
212
179
33

3 | 208
69
1380

2
31400
2800
200) 31200 (171

2.1399
2.1399
1.6464
7.7670
3.6932 4980

171
164
684
1026
171
138) 28044 (203
276

149 2.1732
2.1732
172 1.6464
7.7645
3.7573
5720

444
384
8153
1732
7645
7530
2470

203
171
32

177
172
+5

87

EM7	207 − 210
Rs	$\frac{31400 + 2800}{200}$
C	48.
	Blue in the [illegible]
EM7	175 − 175
Rs	$\frac{31400 + 4300}{200}$
C	16

1380
171 Rs
~~170~~
32 R

138 : 164 :: 171 : x + 171

164
684
1026
171
138) 26044 (188
138
1224
1104
1204
1104

138
66 25

1387
1242

188
171
17

3(206
68
136

314 00
56 00
20)37000
185

2.1335
2.1335
1.6464
7.7328
3 6462 4430

152 2.1818
2.1818
1.6464
183 7.7375
3.7475

5590

+1

88.

EM7	205 - 207	136
Res	$\frac{31400 + 5600}{200}$	185 Res
C	48 little	.37R
EM7	170 - 172	
Res	$\frac{31400 + 7800}{200}$	
C	16	

136 : 164 :: 185 : x : 185
164
740
1110
185
135) 30340 (222
272
311
272
390

222
185
37

3(210
71
142

37650
3100
20/00750
203

203)893260(4352
812
712
606
1066
1015
510

203
164
812
1218
203
142)33492(235
284
509
426
832
710
2 112

203
32

155 2.1903
2.1903
1.6464
204 7.6819
37089

5110

Wy

89

Em7	210 − 213
Rs	$\frac{37650 + 3100}{200}$
e	48
Em7	180 − 180
Rs	$\frac{37650 + 4700}{200}$
e	16 e

1420
Rs 203
4352
32

142 | 164 | 203 $\frac{4}{4}$ 203+4
164
812
1218
203
142)43292(304
426
692
568
124

304
203

3 | 187
62
2
12.4

31400
1500
20 | 32900 | 1.4
20
129
120
9

164 | 681168 | 4153
656
251
164
876
820
560
492

164

141 2.1492
2.1492
1.6464
164 7.7852
3.7300
5370

8153
1492
7852
7497
2503

178
164
+14

90 Tex

Ent	187 – 187	1240
		164 Res
Res	$\frac{31400 + 1500}{200}$	4153 flow
		52 R
e	46	
Ent	160 – 164	
Res	$\frac{31400 + 3000}{2000}$	216 / 164 / 52
e	16	

124 | 164 | 164 | x 164

124 | 26896 | 216
248
209
124
856
744
112

216
164
52

3) 198
66
132

31400
6600
20) 32000
160

16
4

168) 772026 (4825
672
132
128
40
32
82
80

16
8
8

135.

143.7

6153
1303
8356
7812
2198

166
146
20

91 T

EM7	198 — 198	1320
Res	$\frac{31400 + 600}{2000}$	160 Res
		4825
©	48	38 R
EM7	165 — 165	
Res	$\frac{31400 + 2100}{2000}$	
©	16	

132 : 164 : 160 : x 160

164
9840
164
132) 26240 (198
264
1304
1188
1160
1056

198
160
38

3/221
73
2
146

3/4000
4800
20)36000
180

180) 944300 (5246 180
400
443
366
830
720
1100
1080
20

6
80

153 2.1847
2.1847
1.6464
196 7.7077
3.7235

5290

Right

Oct 5 92

EWt	221 - 222
Res	31400 + 4600
	200
C	48
EWt	180 - 180
Res	31400 + 7000
	2000
C	16

Res 1460
180
lbs 5246

22 R

146 : 164 : 11801 x 180
13120
164
146) 29520 (202
292
320
292

480
22

3) 230
96
15 2

200) 10235000 (
5117

152 : 164 :: 200 : 200+x
152) 32800 (215
304
240
152
880

161 2.2068
2.2068
1.6464
7.6655
216 3.7255

5310

93

Ch 230 – 230
Res $\frac{37650 + 24000}{200}$
C 48

1520
Rs 200
5117

15 R

Ch 200 – 200
Res $\frac{37650 + 5600}{200}$
C 16

37650
2000
39650

215
200
15

.94 [illegible]

when goin there
was an are at the
Clamps

3)211
72
140

43000
37400
20)37700

178) 868280 (4878

1562
1424
1388
1246
1420

178
178
1424
48

2.1461
2.1461
1.6464
7.7496
3.6882 4880

95 — The

1400
178 Rs
4877 ft lbs

Em 212-210
Res 4300 + 31400
2 0 C
30R
C 48

Dw 180 - 180
Res 6300 + ~~4300~~ 31400
2 0 0
C 16

140 : 164 :: 178 : x + 178
164
712
1068
178
140) 29192 (208
280
1192
1120
178
30

3213
71
142

31400
5600
37000
185

185) 893269 (4825
740
1532
1480
526
370
1560

185
95
185
1480

96 GAE

E.M.F 212 — 215   1420 Rs/185 4828 ft lbs

Rs 31400 + 5600 / 2000   28R

C 48 Rbs in F...

EMF 180 — 172

Rs 31400 + 7700 / 2000

C 16

283
185
28

142 : 164 :: 185 : x + 185
164
740
1110
185
142) 30340 (213
284
194
142
520
426

3(2 6 0
140
167
835
31400
2100
20)33500(171
20
135
167)866680(5199.150
835
332
167
1658
1503
1550
167
1503

97

Emp	208 – 212
Rs	$\frac{31400 + 2100}{200}$
C	48
Sm	173 – 175
Rs	$\frac{31400 + 2100}{200}$
C	16

167 Rs
140 U
5199
R 28

140 : 164 :: 167 : x + 167
164
668
1002
167
140)27388(195
140
1338
1260
788

195
167
28

72
2
144

171
5
855

171) 918600 (5377
855
636
513
1230
1197
330
342

158

190

My

98

v 144
Reo 171
Albs 5371

Reg 31400 + 2
C 48 23+171

16

31400 + 48

144 : 164 :: 171 : x+171

144
164
684
1026
171

144) 28044 (194.
144
1364
1296
680
576

144
2
288
144
144
4
576

194
171
23

This Lamp was
busted when I
received it.
Jim

2 229
76
152

204) 1023500 (5017 $\frac{16}{204}$
350
204
1510
1428

31400
9500
20) 40900 2045

b : c :: 204 : 204 + x

b : c :: a : a + x

152 : 164 :: 204 : x + 204

b : c - b :: a : x

100

Emp.	228 – 230 — 152 Rec 204 Sells 5017
R.	31400 + 9500
e	48200 — 16 + 204
Emp	200 – 200
R.	180 31850 + 500
e	16

204 — $\frac{204}{22}$ 6

152 : 164 :: 204 : x + 204
164
816
1224
204
152) 33456 (224
304
305
304
16

106

1	16	23	12	47	20	74	25
2	23	24	18	48	22	75	26
3	28	25	23	49	36	76	9
4	28	26	18	50	13	77	15
5	30	27	26	51	49	78	7
6	15	28	2	52	20	79	12
7	22	29	16	53	32	80	[illegible]
8	38	30	10	54	20	81	23
~~9~~	~~3~~	31	25	55	2	82	14
9	52	32	17	56	4	83	25
10	32	33	28	57	13	84	21
11	37	34	8	58	24	85	
12	32	35	15	59	26	86	
13	33	36	20	60	12	87	
14	31	37	5	61	24		
15	34	38	14	62	5		
16	24	39	22	63	29		
17	18	40	7	64	28		
18	10	41	25	65	13		
19	26	42	29	66	22		
20	24	43	28	67	28		
21	14	44	29	68	27		
22	35	45	9	69	33		
		46	32	70	28		
				71	7		
				72	29		
				73	10		

~~2939 3638 R~~
2939

.2939
3638)29390(.82
28504
8860

.82 Webers

48 candles

Volts	R
147	188
143	172
152	188
137	154
140	167
154	195
158	188
156	180
156	182
143	178
143	177
156	209
141	183
146	177
137	169
142	179
143	204
146	179
154	201
140	168
2939	3638

Ka

1363) 9210 (.67
8178
10320
9541

80
7
560 Webers

.82
.99.0
574
738
.67) 79.54 (118 lamps of 16 candles through 1 brush
67
125
67
584

118) 800 (7 brushes to carry 800 lamps, the
826

16 Candles

Volts	Ohms
122	179.5
132	219.25
120	177
127	166
143	222
141	205
136	194
7) 921	1363

.67

20000
65.125
14.875

1.8137
1.8137
3.6274
2.3446
1.2828

1.1723
2.3446

192
26

	Page		Page		Page
1		30	125	65	175
2	99	31	147	6	39
3	73	32	63	7	111
4	71	33	93 ?	8	57
5		34	207	9	67
6	77	35	83	70	127
7	91	36		1	179
8	101	37	71	2	87
9	39	38	193	3	41
10	79	39	77	4	141
11		40		5	
12	81	1	171	6	107
13	95	2	149	7	145
14	75	3		8	133
15	179	4	41	9	119
16	189	5		80	209
17		6	155	1	197
18	195	7		2	93
19	159	8		3	143
20	123	9	51	4	173
21	191	50	[illegible]	5	201
22	185	1	183		
23		2	129		
24	65	3	51		
25	139	4	47		
26	59	5	163		
27		6	109		
28	39	7	135	5	57
29		8	47	6	165
		9	151	7	201
		60	169	8	
		1	121	9	
		2	105	100	137
		3	103		
		4	115		

	Ft lbs Before	Ft lbs After	Ohms Before	Ohms After	
1	5090	5460	188	159	Pt
5	5200	5080	167	166	~~Pt~~
17	4790	5760	179	202	
36	5020	4970	183	182	~~Pt~~
40	4880	4720	163	156	~~Pt~~
43	4930	5600	171	178	
45	4320	5300	212	214	
47	5077	4860	171	166	~~Pt~~
75	4910	5450	162	164	
86	4720	5690	179	187	
87	4980	5720	171	172	
88	4430	5590	185	183	
89	4352	5110	203	208	
90	4153	5370	164	164	Pt
91	4825	5530	160	145	
92	5246	5290	180	196	
93	5117	5310	200	216	
98	5371	5820	171	190	
18	87411	96630	178	180	
	4800 ft lbs before	5368 ft lbs after			

~~Wanted on clamps~~

Volt

91	1	1	147	140
98	5	5	140	138
36	17	17	142	162
17	36	36	144	143
43	40	40	134	129
47	43	43	148	150
40	45	45	144	160
45	47	47	140	135
1	75	75	134	142
75	86	86	138	155
5	87	87	138	149
92	88	88	136	152
90	89	89	142	155
89	90	90	124	141
93	91	91	132	135
68	92	92	146	153
67	93	93	152	161
85	98	98	144	158
		18	2595	2708
			140 average	150 average

2 above — 8d

16 Below — 9

32 Pt Clamps

4/6 ~~Broken~~ ~~garden~~ TKE

64 nickel

3 nickel pour ambans

13 garden

Dull red

30 Volts

TAE

37650
9
46650
233 Ohms

26 Volts just red

26 : 164 :: 260 : 1640

26 ; 164 !!

X black	X red
X red	X black
~~||||~~	~~||||~~ ~~||||~~
	~~||||~~
|||	|||
8	18

MKE

~~||||~~ ~~||~~	~~||||~~
~~||||~~	~~||||~~ ~~||||~~ ||||
10	24
|	~~||||~~ |||

Between 0 - 200 minutes

Albs	
4750 — 5000	10
5000 — 5250	3
5250 — 5500	5
5550 — 5750	2
5750 — 6000	5
6000 — 6250	0
6250 — 6500	1
	26

Ohms	
150 — 162.5	1
162.5 — 175	2
175 — 187.5	7
187.5 — 200	7
200 — 212.5	5
212.5 — 225	1
225 — 237.5	2
237.5 — 250	1
	26

Between 200 - 400 minutes

Ohms	
4500 - 4750	1
4750 - 5000	8
5000 - 5250	6
5250 - 5500	5
5500 - 5750	3
5750 - 6000	0
6000 - 6250	2
6250 - 6500	1
6500 6750	1
	27

TKG

Ohms

150 - 162.5	2
162.5 - 175	5
175 - 187.5	6
187.5 - 200	7
200 - 212.5	6
212.5 - 225	1
	27

Atom 400 on

4000 – 4250	2
4250 – 4500	4
4500 – 4750	1
4750 – 5000	8
5000 – 5250	9
5250 – 5500	2
5500 – 5750	0
5750 – 6000	0
	26

TKE

150 – 162.5	2
162.5 – 175	9
175 – 187.5	7
187.5 200	3
200 212.5	5
212.5 225	0
	26

From 0-200

	Above	Below Average
Ft lbs	17	14
Ohms	14	11
Volts	19	8

TAE

200-400

	Above	Below Average
Ft lbs	7	20
Ohms	14	13
Volts	11	16

[illegible]

	Above	Below Average
Ft lbs	0	7
Ohms	4	4
Volts	1	7

11) 1656
150

.2583 | 3.4121 | 2583
17 | 1.2304 | 1656
152 | 2.1817 | 927
 | | 154

3362 | 3.5266 | 3362
 | 1.2304 | 2124
197.6 | 2.2962 | 1238
 | | 206

marked mistake

88095 | 4.9450 | ~~5244~~
 | 1.2304 | 88095
5180 | 3.7146 | 57685
 | | 30410
 | | 5068

Average of lamps that ~~[illegible]~~ burnt the resistance coils 17 lamps 0-200 minutes out of 26 lamps

TAE

	Volts	Ohms	Ft. lbs
26	154	191	5500
32	160	196	5780
24	160	239	4750
69	144	194	4735
4	137	154	5400
37	148	185	5250
3	152	188	5446
14	148	195	5040
6	154	195	5380
10	143	178	5090
12	156	209	4920
	1656	2124	57685
	150	193	5244
1	147	188	5090
33	162	233	4996
76	150	199	5008
56	166	201	5642
57	152	207	4944
79	156	210	5130
	154	206	5068
	2583	3362	88095

average 11 lamps ~~150 Ohms~~ Volts

Ohms 193 ~~Volts~~

5244 Ft. lbs

6 lamps

Average

~~152~~ 152 Volts 197.6 Ohms 5180

+ 1762	2192	at 6516
168	+ 192	− 62977
1930	2384	69493
1214	1512	43234
5)716	5)882	5)26259
143	176	5252

1762	3.2466
12	1.0792
147	2.1668

2192	3.3408
12	1.0792
182.5	2.2616

62977	4.7994
12	1.0792
5260	3.7202

Average lamps that burnt their resistance coils 200 — 400 minutes from 13 lamps out of 27.

					6516	
52	168		192		5656	
30	142		158		4819	
78	144		191		6348	
57	164	The	188 200		5253	
74	154		197		4800	
77	146	8 lamps	192		4850	
42	148		192		5001	
59	148		194			
46	142	1214 / 152	177	1512 / 186	5046	43234 / 5404
19	146		179		5480	
65	142		168		5317	
51	146		180		5246	
22	146	143	168	176	5170	5252
	1762		2192		62977	

147 Volts, 182.5 Ohms, 5260 Ft.lbs.

9)8
9

From 400 – 48
2 out of 8 burnt residences

81	146	198	4778
50	158	206	5457
	304	404	10235
	152	202	5117

72

~~LF~~ 15

Total Lamps 0 – 100 minute

Volts	Ohms	Ft-lbs
1656	2124	57685
630	786	22463
2286	2910	80148
1143	1455	40074
163	208	5725

6 + 6 = 12 lamps from 100 – 200 minutes

927	1238	30410
910	1147	31725
1837	2385	62135
918	1192	31067
153	199	5178

Average lamps that did not burn resistance from 0 – 200 minutes

10 lamps

49	174	213	6296
~~53~~			
95	140	178	4877
~~68~~			
39	152	172	5950
35	164	223	5340
7	630	786	22463
	157	198	5616
13			
2	158	188	5880
8	141	183	4810
63	143	172	5260
64	156	180	5990
	152	191	4918
	160	233	4867
	910	1147	31725
	151	191	5287

14 Total
~~8~~ lamps

1214
908
2122
1061
152

1512
1121
2633
1316
188

43234
31864
75098
37549
5364

3.3267
1.2788
2.0479

3.4205
1.2788
2.1317

4.4752
1.2788
3.5964

13 Lamps

716
1183
1899

882
1487
2369

26259
41804
68063

146
3.2785
1.1139
2.1646

182
3.3745
1.1139
2.2606

5230
4.8329
1.1139
3.7190

Average Lamps
from 200 - 300 minutes
that did not burn
resistances

6 lamps

61	156	179	6022
20	154	201	5230
70	150	201	4959
100	152	171	5017
25	142	158	5656
31	154	211	4980
	908	1121	31864
	151	187	5301

8 lamps
300 - 400 hours

55	164	198	6017
96	142	185	4828
60	166	214	5704
41	148	208	4660
84	136	167	4900
71	144	169	5435
15	146	177	5346
16	137	169	4920
	1183	1487	41804
	148	187	5225

S Total

841	1690	28819
304	404	10235
1145	1494	39054
143	187	4882

400 – 500 ~~hours~~ minutes

6 lamps that did not burn

38	128	177	4230
18	143	204	4440
97	140	167	5199
34	148	189	5130
85	138	171	4980
80	144	182	4840
	841	1090	28819
	~~105~~ 140	182	4803

TAE

Blue at lamps

0 1 00 5 lamps

Ohms	Volts	Ctles
213	174	6290
217	162	5357
196	160	5760
185	148	5250
172	152	5950
983	816	28607
197	163	5721

TAE

100 – 200 hours

1 lamp Ctls.

150 Volts 199 Ohms 5008

Blue at clamps
200 – 300 ~~hours~~ minutes

9 lamps

Volts	Ohms	Ftlbs
	179	6022
156	201	5230
154	158	5656
142	192	6516
168	180	5246
146	204	5017
152	158	5656
142	211	4980
154		
148	194	5001
1342	1677	49324
149	186	5480

KLG

300-400 ~~hours~~ minutes

Blue at Clamps

6 Lamps

Volts	Ohms	Ft. Cdls
146	179	5480
164	198	6017
166	214	5706
144	169	5435
~~146~~	~~180~~	5296
140	168	5170
906	1108	33054
	185	5509

Cdls = 5.42

Ft. Cdls = 6332

9.6

6.6

TAE

Volts. Ohms. Ft. Cdls

906 — 1108 — 33054

9.342 — 1617 — 41324

5.816 — 953 — 29607

6.54 — 1157 — 29514

— 199 — 5008

— 5124 — 145307

~~Lot 1~~

Blue at clamps

Average of 27 lamps

	Volts	Ohms	ft-lbs
6	879	1157	29514
5	983	816	28607
1	150	199	5008
9	1342	1677	49324
6	1108	1108	33054
27	4260	4957	145507

27/4260/157
27
156
135
210
189
21

Average Volts = $151\frac{16}{27}$
" Ohms = $152\frac{20}{27}$
" ft-lbs = 6352 1/4
of 27 lamps.

Volts.	Ohms.	ft-lbs
6–906	1108	33054
9–1342	1677	49324
5–816	983	28607
6–879	1157	29514
1–150	199	5008
27–4093	5124	145507

400–500 ammeter

Blue at clamps
6 lamps

18	143	204	4440
8L	146	198	4770
50	158	206	5457
97	140	178	4877
34	148	189	5130
80	144	182	4840
	879	1157	29514
5	146	193	4919
	197	163	5721
1	150	199	5008
	149	186	5480
	151	185	5509

TAE

15 1.1761
91 1.9590
.2171

16.5

5 ~~0.6990~~
~~1.9590~~
~~.2171~~

0.6990
1.9590
.7400

12. 1.0792
1.9590
.1202

9)13
14.3

13.2

6. 0.7782
1.9590
.8192

6.6

14 1.1461
1.9590
.1871

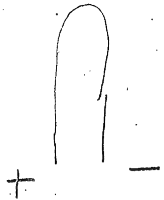
Lamp 87 1415

resistance burned

without lamp lighting

Lamp 43

resistance burned



5

TAS

89)86.00(96.6
801
590
534
560

480
20
460

98
27
71

No 86 480

15 m.

Completely wrecked

No 45

1 45 P.M

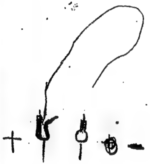
Glass broke

460
45
505

No 75

2 - 35 P.m

$$\begin{array}{r} 520 \\ 25 \\ \hline 545 \end{array}$$

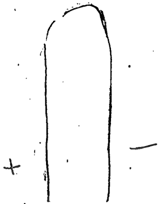


Burnt resistance

No. 93

2-40

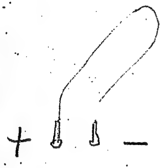
$$\begin{array}{r} 520 \\ 40 \\ \hline 560 \end{array}$$



No 90

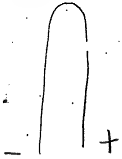
3-32

Burnt resistance



520
60
580
32
612

No 92

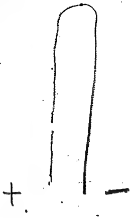


3-45

580
45
625

No 51

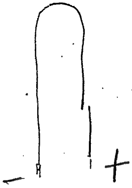
4 P.M



580
60
640

No. 36

4-35



Resistance O.K

640
35
675

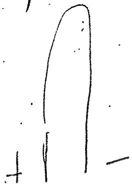
No 17 blue on clamps

88 ——

89 ——

98 ——

89 4-50



$$\begin{array}{r} 640 \\ 50 \\ \hline 590 \end{array}$$

~~TAE~~

98 4-52

Went completely in glass

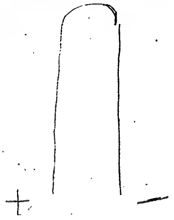
~~[illegible]~~

JAS

Lamps tested

	Volts	Ohms	Sh. lbs
1	143	178	5090
17	broken in test		
40	133	155.2	5050
47	140	166	5220
88	broken in testing		
91	140	144	6030

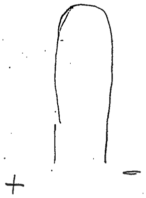
No 1

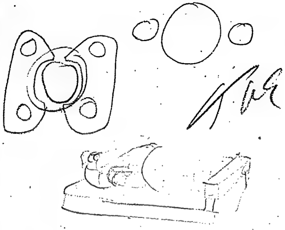


Tat

Did not burn resistance

No 90



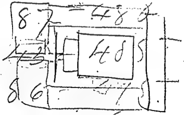


82 — 127

85 - 493

80 - 475

87 = 480



43

86 - 495

45 - 505

75 - 555

93 - 560

1st lot - Test lamp (100 Test)

No of Lamps	Time in Minutes	No of Lamps.	Time Minutes	No	Time	No	Time
54	1	13	124	77	281		
58	10	2	128	31	282		
49	22	8	130	42	284		
53	23	63	133	59	295		
95	27	62	139	46	309	85	473
68	29	76	142	19	314	80	475
26	30	56	153	55	324	87	480
32	40	67	155	96	229	43	485
24	44	64	172	60	351	86	495
69	48	79	187	41	352	45	505
4	56	61	209	84	354	75	553
37	57	20	214	65	355	93	560
3	69	30	215	71	356	90	612
14	70	70	217	15	369	92	625
39	74	53	220	51	374	5	640
6	82	78	235	22	376	36	675
10	87	57	239	16	382	89	690
12	94	100	264	21	385	98	692
35	95	25	266	98	409	80 Total lamps	8042
72	111	74	269	18	421		
7	117	83	271	81	440		
33	123			50	443		
				97	444		
				34	459		
	1309		3836		8488		
82	127						

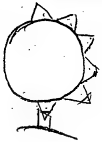
1309
3836
8488
8042

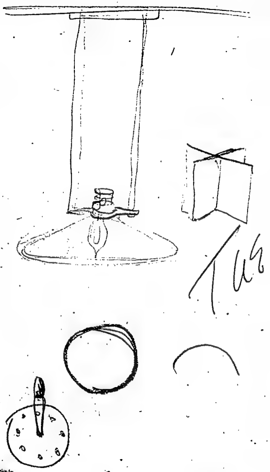
80 | 21675 | 270 min
160XX
567
560
75

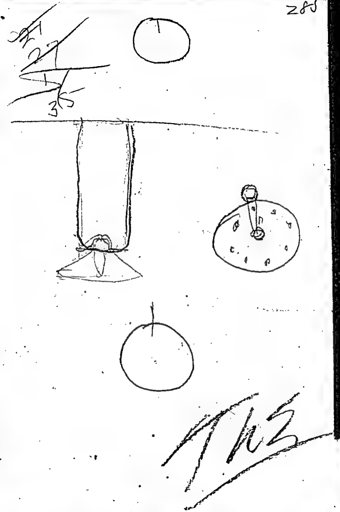
Average time of 1st lot

When no 82 & 51 are added makes a total of minutes.

82 | 22841
268 average







Menlo Park Notebook #120 [N-80-11-25]

The dated entries in this notebook cover the period November-December 1880, but the book was probably begun earlier in the year. All of the entries are by William J. Hammer. Most of the material relates to the gathering of statistics for the Pearl Street district. Included are statistics that were copied from block survey books of the district and from answers to questions asked by the surveyors. There are also tables of tests relating to the second lot of one hundred lamps sent from the lamp factory to the laboratory for testing, a table of the first lot, notes and drawings of lamp experiments, and a drawing of a Brush arc light. The label on the front cover is marked "Electric Lamps Statistics &c &c Figuring," and "Wm. J. Hammer." The book contains 284 numbered pages and has been used in both directions.

Blank pages not filmed: 1-2, 9, 50-53, 90-91, 112-117, 120-123, 128-237, 240-245, 248-255, 270-271, 274-277, 282-283.

Missing page numbers: 3-8, 11-12, 21-22, 261-266.

The next three pages contained figures from which the annexed table was compiled

Hammer

Second Lot of 100 Test Lamps.

Number of Lamp	Volts before Test	Volts after Test	Ohms before Test	Ohms after Test	Ft-Lbs before Test	Ft-Lbs after Test
13	144	161	158	196	5813	5850
18	144	158	169	197	5438	5470
22	136	147	138	140	5937	8450
29	136	147	169	183	4850	5160
36	153	155	178	158	5820	6730
37	140	147	169	164	5120	5840
40	135	143	157	159	5140	5630
42	131	150	151	164	5020	6070
43	137	142	164	159	5060	5820
46	136	144	157	broken	5230	broken
51	137	133	154	147	5400	5300
53	133	135	158	148	4900	5450
57	141	143	179	164	4920	5800
67	127	137	137	127	5220	6060
69	130	131	140	139	5350	5460
70	136	—	157	—	5220	—
83	130	156	158	172	4850	6260
84	129	135	157	161	4700	4580
98	127	139	140	137	5100	6240

4
26
50
72
97
2
17
38
83
0
19
52
80
19
57
79
98
12
52
87
9
79
3
67
40
25
20
20
4

1251

4700
1251

20) 5951

297 squares.

Average per verification.

Belonging to Lot-1

List of 32 Lamps of Lot-1 which burnt their Res.

No	Min	No	Min
26	30	74	269
32	40	77	281
24	44	42	284
69	48	59	295
4	56	46	309
37	57	19	314
3	69	65	355
14	70	51	374
6	82	22	376
10	87	50	443
12	94	81	440
72	111	32	3740 / 6197
33	123		
76	142		
56	153		
67	155		
79	187		
30	215		
62	220		
78	235		
57	239		
	2457		

Average time of burning 198 min.

~~289~~
~~288~~
~~77~~

32)6197(198 min average
32
299
288
117
96

Lot-1.

~~Lamps lasting~~ Lamps lasting ~~[illegible]~~ minutes.

No	
40	1350
47	1050
1	745
17	703
90	790
91	701
9	103
7	5442
82	
89	Total

22159
5442 minutes

89 $\boxed{27601}$ ~~310 Average~~
267X X
90
89
11
89

308 min average

No.	Min.	No.	Min.				
49	6	59	130	12	260	75	570
4	16	56	131	73	277	41	594
77	20	58	133	39	281	6	608
87	30	65	133	33	293	62	630
93	34	61	135	82	295	55	673
52	41	86	138	8	325	15	740
10	45	26	138	72	340	90	783
47	49	27	138	28	361		
24	53	79	144	1	368	Over on next page,	
48	56	66	153	19	368		
78	65	54	162	64	368		
60	68	38	169	23	373		
11	70	17	171	91	375		
85	73	94	175	25	378		
81	78	45	176	2	392		
47	80	68	176	88	403		
14	90	44	180	89	438		
92	98	96	181	50	448		
9	108	1	190	80	473		
3	113	21	203	5	496		
31	119	32	203	16	523		
95	120	76	203	20	527		
7	121	35	214	63	530		
74	123	71	238				
		34	243				

8 - 241
11 - 812
15 - ~~7~~922
10 - 1734
6 - 1304
5 - 1406
2 - 665
7 - 2615
3 - 1289
2 - 969
2 - 1580
2 - 1166
2 - 1238
1 - 673
1 - 740
1 - 783

79 — 19137

1 - 808
1 - 808
1 - 813
1 - 816
1 - 816
1 - 821
1 - 828
1 - 845

6650

1 - 903
1 - 912
1 - 919
1 - 925
1 - 940
1 - 970
1 - 1130
1 - 1182
1 - 1220
1 - 1315
1 - 1355

98 - 11771
6550
Lumps: 19137
98 | 37458
382

N.Y. Gas Light Co. - 102 consumers.
Mutual " " 17 "
Book 4
Mutual City Gas 8 "
Kerosene 33 "
Candles 9

Do not use any light 9 parties.

No of Jets without globes = 1036
" " " with clear " = 184
" " " " ground " = 279
" " " " Zin Shades = 82

Did you ever notice any perceptible leakage — Yes = 76, No = 0, Don't know 1

Are you bothered with the heat — Yes = 42, No = 77

over

Do you glo[?] gums { Yes 128
No 2

Do you use gas for heating.
{ Yes. 30
No.. 96

used for following purposes
glass blowing = 3 parties.
heating glue = 10 "
Soldering = 7 "
Embossing = 2 "
laboratory use = 1 "
heating irons = 1 "
Varnishing = 1 "
showroom = 1 "
heating = 3 "

Style of flames.

4	5	6
32	98	1

2 Reflectors = 4 jets each.
2 " = 5 " "
6 " = 6 " "
2 Chandeliers 4 " "
6 segar lighters.

Are there times when you have to regulate the jet to keep it right when it is varied by difference in pressure.

Yes. 126
No - 3

Do you like the gas sold you

Yes 51.
No 74.

Is it found that the 50 grains of Sulphur thrown into the atmosphere at your place, damages your paint or good. Yes 0 No 125

Did you ever take gas from any other Co.? if so which, + how does it compare with this.

Yes = 12

No = 122

Remarks. 3 = Use Mutual like N.Y. best
2 = " N.Y. " Mutual "
2 = " " " " N.Y. best
2 = " both Co's gas,
2 = " Can see no diff.
1 Had Mutual smoked too much to use.

Do you use an Engine? - if so Whose?

1	Hewes and Phillips	80	Horse Power
1	Buckeye Engine	30	" "
1	Allen Cut-off	50	" "
1	Roper Caloric.	2	" "
1	Hubbard & Allen	6	" "
2	Otis Bros,	10	" "
		10	" "
6	Baxter Engine	8	" "
	" "	10	" "
	" "	4	" "
	" "	4	" "
	" "	4	" "
	" "	10	" "

Continued on next page,

{ Erie Engine — 40 H.P.

1 { Snedicor " — 10 H.P.

1 { Hittenger Cook Co — 40 H.P.

Dont know makers name

2 { 1 — 8 × 8
1 — 8 × 7

Also 2 Duplex air pumps

Is your Boiler Horizontal or upright —?

Horizontal 9

Upright — 2

Do you rent power if so how much do you pay for the whole or per H.P.

\$150 year	45.00 month	4.00 week	\$ 181.50
500 "	5.00 "	3.00 "	Total per month
150 "	12.50 "	6.00 "	

7 have it included in their rent.

3 Gave no definate amount

How much Horse Power do they charge you for

Total Amt. 108 H.P

Did not know. 4 parties.

Would not tell. 1

Note - Fewer parties answered this question than the next.

How much do you think you use?

Total 236 Horse Power.

2 parties use all they can get.

2 Dont know.

Note, almost all the subscribers think they get or use less than is charged them but he collected many more answers to this question, hence seeming discrepancy in amounts.

What proportion of the time do you use it:

All the time	28
2/3 of time	2
1/2 " "	2
3/4 " "	1
Nearly all the time	1

How much coal do you use per day week or month.

Total 63 1/2 Tons per week.
1 1/2 Chaldrons of coke.

Note, it will be remembered many hire their power.

Have you any machinery driven by foot power.

No 95

[illegible] & 3 parties employed as follows.

1. spinning wheel
1 - (2) blowers for (2) [illegible]
1 - cutter.
1 - 30 lathes.
1 - 4 machines
1 - 2 "
1 - 4 stove pipe machines
1 - 5 lathes.
1 - 7 "
1 - 2 presses

1 - 4 presses
1 - 1 "
1 - copper cutter
1 - press
1 - 2 lathes
1 - spindles.
1 - 6 machines.
1 - 7 lathes.
1 - 6 lathes.
1 - 1 press
1 - 4 presses

This on next Page

(over)

Have you any machinery driven by foot power?

Yes	No
1 for spinning wheel.	𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸
1 " Bellows for flowers.	𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸.
1 " Cutter	𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸.
1 " "	95 No
1 " 30 Lathes.	
1 " 4 machines	1 - 6 lathe.
1 " 2 "	1 - 1 press
1 " 4 stove pipe machines	1 - 4 "
1 " stamp machine	1 - sewing machines.
1 " 5 lathes	1 - 6 lathes.
1 " 1 "	1 - Embossing machine.
1 " 2 "	1 - 4 lathes.
1 - 4 presses	1 - 2 lathes.
1 - 1 "	1 - ~~for~~ Bellows
1 - 1 "	1 - sewing machines.
1 - 1 copper cutter	1 - lathe
1 - presses	33 parties yes.
1 - 2 lathes.	
1.	
1 - spindle	
1. 6 machines	
1 - 2 lathes	

How far do your vaults extend toward the curb or edge of sidewalk.

Even with the curb	6 ft	Within 8 ft	Within 9 ft
52	1	1	1
	1	1	1

Have you good ventilation or are your rooms oppressive in summer.?

Yes	Fair	No
88	31	4

What is your insurance rate.

1/2 per ct	2 per ct	3/4 per ct	2 1/2 per	1 per ct	1 1/4	7 per ct	2 1/4	35 per ct	[illegible]
9	5	9	2	27	4	5	10	7	[illegible]

40 per ct	45	50	60 per ct	65	70 per ct	75	90 per ct	80
18	11	6	7	1	2	3	1	2

Don't know 6

What time Do you close in Winter and Summer

Winter		Summer	
4	3	4	3
4.30 / 5	3	4.30	3
5.30	19	5	
6.00		5.30	20
7	8	6	
8	4	7	7
10	6	8	3
	109	10	6
			109

Have you a Hoistway

Yes	Elevators
卌. 卌. 卌. 卌. 卌 卌. 卌. |||	2 steam
38	1 "
	1 "
	1 "
	1 "
	1 "
	1 "
	1 "
	7 " seven elevators
	17

Book 5
Commencing at 146 + 148 William St
to Fulton to Gold to Ann St.

From South West cor Beekman
and William. to Nassau, to Ann
down to 57 + 59 Ann.

Book No 2

What Co. supplies you with gas.

Mutual	N. York
10 Mutual	162 N.Y.
Kerosene	**Candles**
48 Kerosene	12 Candles
Do not use any light	**Decline to give inf.**
18 none	1

---

continuation of Book 2

What is the actual no of burners. from 8 am, to 5 P.M. in Summer.

1/2 light	𝍸𝍸. 𝍸. 𝍸. 𝍸 𝍸. 𝍸 𝍸. 𝍸𝍸, 𝍸. 𝍸. 𝍸 𝍸 70.	use only on cloudy days 1

What is the no burnt from 8 am, to 5 P.M in Winter.

1/2 light	𝍸. 𝍸. 𝍸 𝍸 𝍸 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 ||| 88	use only on cloudy days 1

From 5 to 6 P.M in ~~Winter~~	From 5 to 6 P.M in Winter.
𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 | 86	𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 𝍸. 𝍸. 𝍸. 𝍸. 20-8.12.6. 12-9-6 5-7-4-12-24-25-21-39-23 6-24-13-30-14-10-18-22 18-17-7-22-7-11-8-15 8-35-30-32-13-35-39

70
53
98
135
135
226
717

8 12 6 12 9 6 = 53

5 7 4 12 24 25 21 = 98

39 23 6 24 13 30 = 135

11 16 18 22 18 24 27 = 135

11 23 3 4 18 48 39 = 226

51
132
23
133
106
32
60
33
30
42
114
41
31
88
45
21
39

1044

6

64
27
16
25
44
33
41
263

3

continuation of Book 2.
From midnight to 8 A.M.

~~𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸 III~~

53.

How many gas jets have you without globes.

𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸 I - 51

61.66.19.6.43. 110-76-30-9-24, 24.36.6.27
22.8.21.21.70.44.21.6.14.20,11.68.20.21.24.
4.17.26.13. - 1044

How many have clear glass globes

𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸 I

51

How many have you with ground glass globes.

𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸 I
76 = 𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸 I 18.26.
64.12.12,13.16.9.4.12.6.18.9.11,21.7.5.

263

Tin Shades 3
III

Do you use gas for Heating?

Yes	no
𝍸 𝍸 𝍸 III	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸
18	75

How many ½ lights? If any groups of small jets are used how many? &c

	Segar Lighter
IIII	𝍸 𝍸 𝍸
4	15

Do you use an engine If so
Whose make is it.

Wilson & Roacke. Do not know the name of maker

Neal
Sedgewood & Co
Borden
Todd and Rafferty
Baxter Caloric.
Erie City

Hydraulic Hand presses.

How much coal do you use per day week or month for power.

1 Ton per week	1 Ton per month
1 " " "	10 " " "
1 " " "	$1\frac{1}{2}$ " " "
	7 " " "

1 Ton per day

12
30
10
1
7
$1\frac{1}{2}$ Total
$61\frac{1}{2}$ Tons per month.

Do you have a specially Employed Engineer or does he other work, if so what proportion on the Engine

1. No Janitor tends the Engine. Yes
1 makes himself generally useful. ~~||||~~.| = 6

Do you rent power If so how much do you pay per Year for the whole or per H.P.

How many horse power do they charge you for.

1 Horse Power.
1 " "
4 " "
10 " "
20 " "
3 " "
39 H.P. Total.

How much do think you use

11 Horse Power. Dont know.
3 " "
15 " " Use a horse for hoisting.
29 111

Do you use that power all the time if not what proportion.

Yes 1/2 the time.
11
2 yes

Have you any machinery driven ~~machinery~~ by foot power.

1 sewing machines. 1 – 4 card presses
1 " " 1 – 3 lathe machines
1 " " 1 – 1 sewing machine
1 " " 1 – 2 " "
1
1 " " 1 – 1 " "
1 2 drilling " 1 – " " 18
1 2 " 1 – " "

How far do your vaults extend towards the edge of the side-walk, –

Even with the curb
~~||||~~. ~~||||~~. ~~||||~~. ~~||||~~. | = 21

1 (1) within 4 1/2 ft of curb
1 (1) " 4 " "
~~||||~~ – (5) " 5 " "
||| – (3) " 6 " "
| – (1) 7 " "
23 = ||| (19). ~~||||~~. ~~||||~~. ~~||||~~ ~~||||~~ 10 " "
(18) ~~||||~~. ~~||||~~ ~~||||~~. ||| 8 " "
(29) ~~||||~~. ~~||||~~ ~~||||~~ 9
2 = || within 13 ft of curb
1 = | within 12 ft of curb
3 = |||| within 11 ft of curb
|| – (2) Beyond the curb

Have you good ventilation.

Fair
~~||||~~. ~~||||~~. ~~||||~~. ~~||||~~
~~||||~~ |
26

Yes
~~||||~~. ~~||||~~. ~~||||~~.
~~||||~~. ~~||||~~. ~~||||~~. ~~||||~~
~~||||~~. ~~||||~~.
45

Poor
~~||||~~. ~~||||~~. ~~||||~~
~~||||~~. ~~||||~~. ~~||||~~
|
31

What time do yo close

In Winter		In summer	
9 — ||||	4	10 — 𝍸	5
5 — ||||	4	5 — ||||	4
5.30 — 𝍸 𝍸 𝍸 𝍸 |||	23	5.30 — 𝍸 𝍸 𝍸 𝍸 |||	23
6 — 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||	52	6 — 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||	52
7 — |||	3	12 — |||	3.
12 — |||	3	p.m. 3 —		1
p.m. 3 —		1	p.m. 11 — |||	3
p.m. 11 — |||	3	8 — 𝍸 ||	7
10 — ||||	4	9 — ||||	4
8 — 𝍸 ||	7	7 — |||	3

all the time — 𝍸

|| close at 7 p.m. open at midnight (restaurant)

Book 3

What Co. supplies you with gas?

N. Y	Mutual.
107	17
Kerosene	**Candles**
27	8
City Gas	**Do not use any light:**
8	9

w From 2 a.m to 7 am = 8.3.1. = 12

w From 3 a.m to 7 a.m = 8.2.3.2, 2.5. = 22

w From 4 a.m to 7 a.m = 4.3.3.3.3.4.2.1.4 = 30

w From 5 a.m to 7 a.m = 3.4.2, 3.5. 3.3.3.3.8.8.7.8. = 55

w From 6 a.m to 7 a.m = 12.2.2.56, = 72

S. From 5 a.m to 7 a.m = 3. = 3

From 4.45 P.M till daylight (7) a.m

56

What is the actual number of ~~3~~ jets burning from 8 a.m. to 5 P.M in summer.

24 = 59

What number do you burn from 8 a.m. to 5 P.M. in winter.

24 = 120

Refer also to opposite page

H–

over.

From 5 to 6 P.M. in Winter.

26, 30 . 117

415, 125

30, 31, 39

40 =

326
56
117
415
125
100
40
1179 Total.

From 5 to 6 P. M. in Summer?

𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸
|| = 77 Total.

How many gas jets have you without globes?

318
64
47
372
37
80
24
32
77
1051

𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 37. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸.
𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 𝍸 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸.
𝍸. 𝍸. 𝍸. 64. 47. 372. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 𝍸 𝍸 𝍸
𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 80. 24. 𝍸. 𝍸. 𝍸. 𝍸.
𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 ||| 24. 53.
32.

How many have clear glass globes?

𝍸 . 104 . 17. 𝍸. 𝍸. 𝍸.

104
17
20
141

How many have ground glass globes?

159
51
117
327

38. 18. 𝍸 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 117. 𝍸. 𝍸. 𝍸. 𝍸.
𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 𝍸. 𝍸 𝍸 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸
𝍸. 𝍸. 𝍸. |||.

In Shade. 20.8.3.2.1.- 34

— 3

Do you use gas for heating.

Yes

2 Heating
1 " office
1 " tea
1 " sealing wax
1 " coffee

for argan light

1 heating iron
1 gas stove tea
1 glue pot
1 oysters
1 by barber
1 heating water

1 blowpipes
1 soldering

= 21

No

106

How many ½ lights, If any in groups of small jets are used, how many? How many in each group?

reflector
1
14 ref – 4 burs each
6 " – 6 " "

How far do your vaults Extend

Even with the curb

//// = 4 over the river

within 12 ft - //// = 4 + 2 = 6

within 9 ft - ////. ////. ////. /// = 18

within 10 ft - // = 2

within 11 ft - ////. // = 7

~~within 12 ft - // = 2~~

within 8 ////. ////. //// = 14

within 6 ft - // = 2

within 7 ft - / = 1

3

Have you good Ventilation

Yes	No
95	13

Fair

21

What time do you close in Winter & Summer.

15 = 5.30 – 𝍸 𝍸 𝍸
59 = 6 – 𝍸 𝍸 𝍸 𝍸 … 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||||
8 = 6.30 – 𝍸 |||
27 = 7 – 𝍸 𝍸 𝍸 𝍸 𝍸 ||
4 = 9 – ||||
1 = 9.30 – |
1 = 12 – |
12 = 5 – 𝍸 𝍸 ||
4 = 3 – ||||
1 = 3.30 – |
32 = 4 – 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||
2 = 8 – ||
4 = 10 – ||||
1 = 11 – |

never close
|| = 2

all night –
| = 1

Book 5

From 8 A.M. to 5 P.M.

Summer.

2	4	2
2	35	1
2	1	1
1	1	1
1	3	1
5	2	2
1	1	2
1	1	2
1	1	127
3	2	13
13	1	
2	1	
1	1	
1	1	
1	1	
4	4	
1	1	
1	1	
1	1	
5	1	
2		

76
51
127

Book 5

From 8 am to 5 P.M

Waiter

2	1	1
1	6	1
2	1	1
8	2	2
2	6	1
7	35	1
1	1	2
2	1	2
1	1	2
2	3	3
3	1	3
15	4	160
4	2	
1	1	
1	2	
1	1	
1	1	
6	2	
1	1	
1	1	
	1	
	4	

From 5 P.M to 6 P.M

~~Summer~~

Winter

25	5	3	4
10	12	0	2
6	7	13	10
10	20	8	6
7	5	8	6
5	4	15	12
14	20	4	6
6	4	9	26
12	6	6	1
8	7	12	6
26	7	2	6
10	20	14	6
8	3	3	10
4	2	8	6
20	35	8	6
3	1	4	4
30	1	4	6
12	8	2	20
6	1	8	4
12	10	8	15
30	20		12
			6
264	198	139	180 = 781 Total

264
198
139
180
781

Book 5

From 6 P.M. to 7 P.M.
Winter.

2
6
10
7
2
27
26
53
4
3
60
1
13
74
2
1
13
2
4
1
97
6
4
1
108
8
6
1.22
1
2
125

Book 3

From 7 P.M to 8 P.M

Miles.

2
4
3
———
9
2
10
———
21
3
1
8
8
2
1
8
8
———
55
2
1
1
8
———
67
1
2
———
70

Book 5

Mutual.

𝍸. 𝍸. 𝍸. 𝍸. 𝍸.
𝍸. 𝍸. 𝍸. IIII

<u>44</u>

New York

𝍸. 𝍸. 𝍸. 𝍸. 𝍸. 𝍸 𝍸. 𝍸 𝍸. III
𝍸

<u>54</u>

Kerosene

𝍸. 𝍸. 𝍸. 𝍸 𝍸 𝍸 𝍸
~~[illegible]~~ 𝍸. 𝍸 𝍸 𝍸 𝍸 𝍸.
𝍸 𝍸. III. = 79 parties
5.2.1.3.2.4.4.3.1.2.1.2.25
2.2. 2.1.2. 1.1.1.1.1.1.1.1.
1.1.1.1.11.3.5.4.4.1.1 2.1
1.1. 2.1 1 1 1 1 1 1 1 1
6.2.2.2. 2.1.2.4.3 4.6.4.
4.4. 4. 3. 6.31. 10.3,4.6
2.5. 6.7. 4. 72
= lamps

Don't use any
light

𝍸.
<u>5</u>

Candles

1. = <u>1</u>

<u>All Night.</u>

2.1.1.2.1.1.2.1.3.2.1.1.1.1. = 20

8 to 10 =

11 = 1

8 to 9

3.5 = 8

9 to 10

10.3 = 13

10 to 11

8
26
1
12
6
6
12
6
6
3
6
20
4
15
16
12
6

10

25 2

160

8

Gas Jets without Globes

10	25	12	4	2	25	4	10	1	
20	7	12	20	8	23	30	12	24	Argand
14	2	4	1	2	10	16	10	6	Burners
6	8	6	20	4	9	6	2	6	
14	1	8	20	2	9	25	4	6	
4	6	12	4	10	12	4	2	6	
3	30	8	24	2	1	26	2		
7				6		3	50	= 849	81

With Clear Glass Globes

6.1.8.0 = 15

Fire Shades

10

With ground glass globes

16	1	7	59
12	6	6	
2	4		
1	4		

opal globes

20	26	4	= 87
8	2		
1	8		
14	2		
	2		

8
24
1
12
6
6
12
6
6
3
6
20
4
15
16
12
6

16

252

165

8

Gas Jets without Globes

10	25	12	4	2	25	4	10	1	Argand
20	7	12	20	8	23	30	12	24	Burners
14	2	4	1	2	10	16	10	6	
6	2	8	20	4	9	6	2	6	
14	8	8	20	2	3	25	4	6	
4	1	8	4	10	9	4	2	6	
3	6	12	24	2	12	26	2		
7	30	8		6	1	3	50		

= 849

81

With Clear Glas Globes

6.1.8.0 = 15

Tin Shades

10

With ground glass globes

16	1	7
12	6	6
2	4	
1	4	

59

opal globes

20	26	4
8	2	
1	8	
4	2	
	2	

= 87

Book 5

Bothered by Heat

Yes		No		
5	3	2	1	
1	1	2	1	
1	1	3	1	
3	1	2	5	
2	2	3	1	
3		3	2	
1		4	3	
2		1	1	
1		3	3	
3		1	1	
2		1	5	
2		3	3	
			2	
			4	
34			63	

55.75
17.00
52.50
11.75
54.00
4.92
49.50
15.50
25.83

59 | 286.75 | 4.86
236
507
472

28 | 117.56 | 4.19
112
55
28
276
252
14

Year

7.00
5.00
12.00

59

Book No 5.

For Jan, or Dec.	June or July			Per Month	bills
6.00	1.58	3.00	12.	1.75	286.75
7.50	.50	2.00	.50	1	4.19
2.00	1.20	4.00	10.	1	average for 59 bills
4.50	2.00	1.00	[illegible]	80	
11.00	2.00	1.00	4.00	3	
45.00	20.00	1.50	18.	1.00	4.92
3.80	1.24	1.50	4.00	2.50	
56.08	28.04	8.00	1.25	.50	
3.37	.20	3.00	2.00	6.00	
8.00	.50	3.00	6.00	1.50	
11.00	5.40	2.00	3.00	20.00	
7.00	5.00	1.00	3.00	5.00	
		4.00	3.00	2.00	
		4.00	9.00	15.00	
		3.00	35.00	2.00	
		4.00	2.00	2.50	
		5.40	2.50	3.00	
			4.00	1.00	
			2.00	3.00	
			1.50	2.00	
			16.00	2.00	
			1.25	.25	
			1.00	5.00	
			8.00	15.00	
			7.00	1.50	
			5.00	.60	
			6.11	1.00	
			25.00	1.50	
			3.00	1.00	
			54.00	25.83	

157.25 | 67.66 | 49.90

67.66

117.56

13.10 average for Jan or Dec.

28 bills

4.19 average of 28 bills for June or July

Dont Owner tell what they pay
2 N. P.

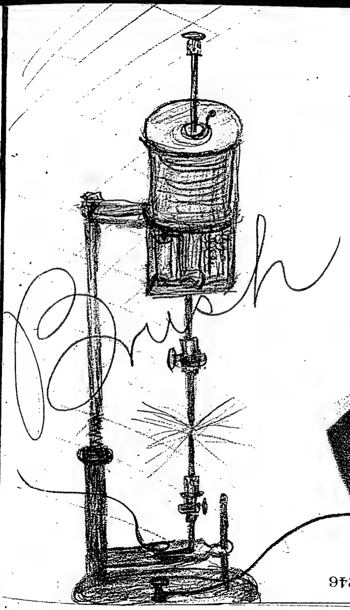
145
38 1/2

Book 4

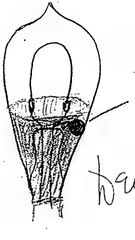
2 Horse Power "	1 Horse Power
55. per month.	4 "
7 Horse Power.	2 " "
6 Horse Power.	
7 " "	2 " "
8 " "	4 " "
40 " "	4 " "
10 " "	2 " "
15 " "	
50 " " Reduction Power	3 " "
2 1/2 " "	1 " "
1 " "	
2 " "	4 " "
5 " "	2 " "
4 " "	4 "
2 " "	10 " "
2 " "	50 " "
10 " "	2 " "
10 " "	4 " "
	40 " "

10 Horse Power

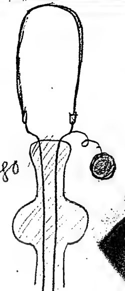
Edison Electric Light Co.,
New York


Brush

Wm J. Hammer



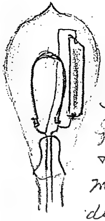
Dec 7-1880



Globe lined inside & coated outside with platinum foil the inside part having pith ball coated with platina on one wire which made contact with inside coating the other wire to be connected with outside coating

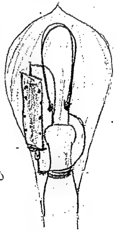
Made two & the plating on one twice the height of the other

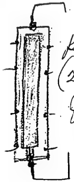
Dec 1880



Condenser of tinfoil & mica several from 3 to 7 layers foil, fastened with shellac & gum tragacanth which volitilized & deposited on carbon changing resistance greatly

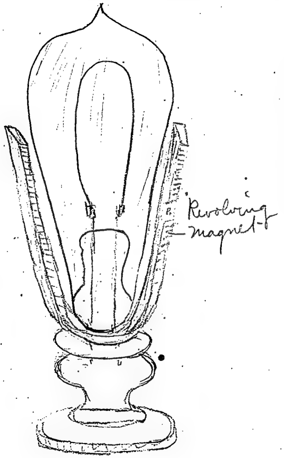
Dec 7-1880





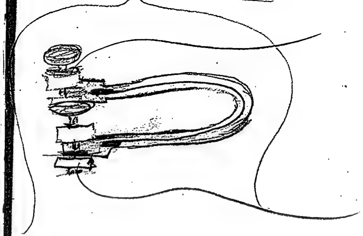
In this used platina foil (2-of 5 & 6 sheets) fastened the mica plates together with .005 platina wire setting condenser further down & getting firmer clamping

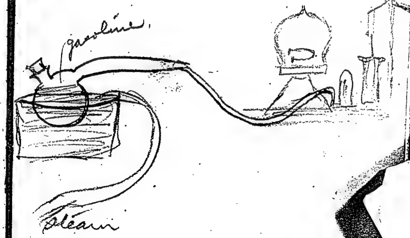
Nov 1878



Sg. Wm J. Hammer

DEC 4-1880.



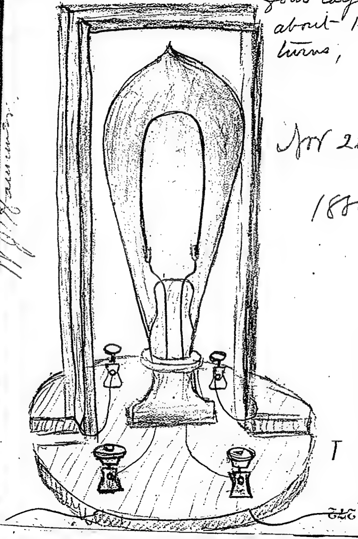


W J Hammer. over

Coil of no 28 wire four layers about 150 turns,

Apr 25

1880



T

170,684 / ~~9116800~~ / 50
89607 0X
156100

229,020) 931,7900 (4

170,680 / 9116800 (5-3
853400X
582800
512040
70760

179,214 / 4517800 / 25
358428X
933520
896070

170,680
5
853400
170680
179214.00

~~179214.0~~ / 938,4900

179,214 / 9116800 (5-6
896070X
1156100
1075284
80816

137,970.00
46,802.00
$91,168.00 Net Income

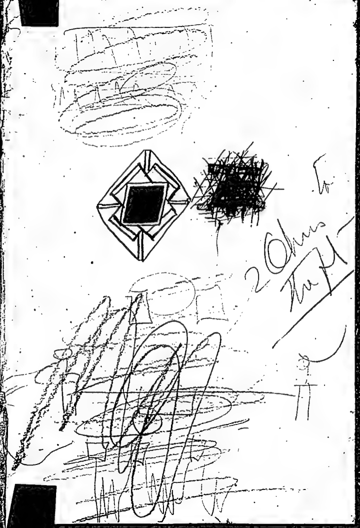
170,680.. / 91,168.00 / 5-3
85340.0
58280
51204
760

170,680.
.05
8534.00
170680
179214.00

7482.50
4000.00
8190.00
2190.50
7000.00
28863.00
7200
$3607.50
10731.00
46,802.00

[illegible] 170680

47



Menlo Park Notebook #121 [N-80-10-15.1]

This notebook covers the period October 1880-February 1881. Most of the entries are by Francis Jehl. There are also a few entries by Francis Upton. All the entries relate to tests of lamps sent from the lamp factory to the laboratory. There is also a copy of a memorandum by Charles Batchelor regarding these lamps. The label on the front cover is marked "Lamps Lot 1," "16 C," and "Francis Jehl." The book contains 284 numbered pages.

Blank pages not filmed: 44-45, 112-115, 126-143, 168-279.

E. M. F. on Bush Arc for lights 1400

230
2
3) 460
140

Emf
C
R

195 - 194
16

37650 + 300

200
Fused, on Oct 22
at Ten P.M.

195
194
3 | 389
129

1295
189 R
36 ohm

37650
300
20 | 37950 (189

There Lamp was put on at 10.20 Oct 15/80

No 2

Ex 7	213 – 214
R	$\frac{37650 + 3100}{200}$
C	16

213
214
3)427
142

1420
203 R
17 ohm

37650
3100
20)40750
203

Ell7 222 - 221

R $\frac{37650 + 9200}{200}$

C 16

1470
234 R
~~332~~

$$\frac{222 + 221}{3} = \frac{443}{3} = 147$$

$$\frac{37650 + 9200}{200} = \frac{46850}{200} = 234$$

went up about 9 oclock
oct 16 1880

no 4

Emit 189 – 186

$$\frac{37650 + 300}{200}$$

R

1255

189 R

e 16

440 lms

189
186
3)375
125

37650
300
20)37950 (189
20
179
160
195
180

burst Oct 20 1880
at ten oclock

EW7 203 - 203

R $\frac{37650 + 3000}{200}$

C 16

1350
203 ohms
28 ohm

203
203
3|406
135

37650
3000
20|40650
2033

No 6

R	$\frac{37650 + 8900}{200}$
Emf	222 - 222
C	16

~~16~~ 1480
232 R
17 ohm

$$\begin{array}{r} 222 \\ 3\overline{)444} \\ 148 \end{array} \qquad \begin{array}{r} 37650 \\ 8900 \\ \hline 20\overline{)46550} \\ 232 \end{array}$$

No 7

Em7	189–189
R	$\frac{37650 + 2700}{200}$
C	16 1265 201 ohms 44 ohms

189
2
3)378
126

37650
27
20)40350
201

No 8

EM7	198 — 198
R	37650 + 3000
	~~7~~ 200
C	16

132 v
203 Res
33 R

198
2
3|396
132

37650
30
20|40650
203

No 9

EmF | 198 — 198
R | $\frac{37650 \times 1200}{200}$
C. | 16 | 1320 / 194 R / 24 R

$$\begin{array}{r} 19.8 \\ 3 \overline{) 396} \\ 132 \end{array}$$

$$\begin{array}{r} 37650 \\ 12 \\ \hline 20 \overline{) 38850} \\ 194 \end{array}$$

No. 10

EMF	230 - 232
R	to light
C	16 154 v — R to light

230
232
3|462
154

went off about 9 o'clock
oct 11 1880

No 11

Em 7 198—198

R 37650 + 1200

200

1325

194R

C 16

24R

198 37650

2 12

3|396 20|38600

132 194

Busted at 2 oclock

oct 18/890

No. 12

Em7	202 – 202
R	$\frac{3700 + 37650}{200}$
C	16 1340 206 R 30

202
3
3(404
1342 0) 41350 (37650 + 3700)
206

Burled at about
8 oclock Sept
Oct 20 1880

No 13

Em7 2.05 – 205

R $\dfrac{37650 + 6100}{200}$

C 16

1365
218 R
28

$$\frac{205}{\cancel{100}}$$

3(416

13620(43750

37650
61

218

Aut. 180 – 180

R $\frac{31400 + 3600}{200}$

C 16

1205
175 R
49 R

180
2
2)360
120 2) 35000
175

314000
36

Busted at 5.45
Sat Oct 6 1880

EMF 220 — 220

R 37650 x 24500

200

C 16

146 V
210 R
11

220
3|440
146

37450
45
20|4215
210

went up at 7.45
oct 18 1880

No 16

Elect 215 — 213

R $\frac{37650 + 8800}{200}$

C 16

142 U
232 R
19 %

215
213

37650
88

$3\overline{)42820}$ | 46450
142 | 232

No 17

EMF 213 - 213

R 37650 + 4200

200

C 16

142 V
209 R
17 R

$$\frac{213 \times 2}{3} = \frac{426}{3} = 142$$

$$\frac{37650 + 4200}{200} = \frac{41850}{200} = 209$$

~~Broke~~ ~~Bursted at the~~

~~[illegible]~~

Busted ~~of~~ about five oclock Oct 15 1880

J

No 18

EMF	189 – 189
Ro	37400
C	200 16

126 v
187 R
33 ohm

189
$\frac{2}{3)378}$ 200)37400
126 187

75

Busted at half past one oct 20 1880

Out 208 – 208

R $\frac{37650 + 5500}{20}$ 1380 215R

C 16 25R

208
2
3)416
138

37650
5500
20)43150
2155

138 1156 215
154
860
1075
215
138)33110 (240
276
551
542

240
215
25

Went up at 7:379 Oct 16/1880

Ar no 2

E117 ~~2010~~ 210-210

R $\frac{37650 + 7500}{200}$ 220 lbs

C 16

37650
7500
20)45150
225

210
2
3)420
140 : 154
225
770
3
308
30
14)3465 (247
28
66
56

37650
75
50
247
225
22

went up 9·7/8 about 15
oct 16 1887

aix no 3

Ent 242-243

R $\frac{37650 + 25000}{2000}$

C 16

$$\begin{array}{r} 242 \\ 243 \\ \hline 3\,)\,487 \\ \hline 16 \end{array}$$

Rot no 2 Oct 18 – 1880

EMF	218 – 2.18
R	$\frac{37650+1200}{200}$
C	16

2

EMF 228 – 227

R $3\dfrac{1400+4400}{2000}$

·48

@ Blue at the (Camp

EMF 212 – 212

R $\dfrac{31400+6000}{200}$

@ 16

Emf 240 — 240

Ro 37 ~~650~~ + 4500

C 200

16

Blue at clamp

Emf	220 - 222
R	$\frac{31400}{2000}$
C	48 Blue oil Clamp
Emf	190 - 190
R	$\frac{31400 + 1000}{2000}$
C.	16 Blue oil Clamp

EMC
R
©

very high resistance

Em+

238–240

to high resistance

7

Ent 2φ8 — 2φ8

R $\frac{37650 + \cancel{3}500}{200}$

C 16 Blue at the Clamp

8.

Exit 7 Hg in the globe and Blue at the Clamp
194 — 198

R $\frac{31400 + 4500}{2000}$

C 16

EM7	208 – 210
R	$\frac{37650 + 200}{200}$
C	16

Hg in the globe
Blue at the Clamps

Emt 215 ~ 217

R $\frac{37650 + 2000}{2000}$

© 16

Blue at the Clamps

Em7	212 – 215
R	$\frac{37650 + 1800}{2000}$
C	16

Blue at the Bump

12

Emt 210 - 207

$$\frac{37650 + 2000}{2000}$$

R

C 16

Bene at the Clamps

1-3

Ent 207 – 207

R $\frac{37650 + 500}{200}$

C 16

Blue on the Clamp

14

Eu7 222 – 222

R $\frac{37650 + 5700}{2000}$

C 16
Blue at the Clamp

15

Ell 4 211 — 212

R $\frac{37650 + 4000}{2000}$

C 16

Hg in the glass and
Blue at the Damp

16

Cut 198–198

R $\frac{31400 + 21.00}{200}$

C 16

Blue at Clamps

17

Eu7 226-228

R $\frac{37650+1500}{200}$

C 16

Blue at the Damp

Elu7	200 - 200
R	$\frac{37650 + 2000}{200}$
C	16
	Blue at the Clamp

Exit	Hg in this globe 206-207
R	$\frac{31400 + 5200}{200}$
C	16
	Blue at the Clamp

Em7	200 - 200
R	31400 5200 / 200
C	16 Blue at the Clamp

21

Em7 202 – 202

R $\frac{31400 + 4500}{2000}$

C .1φ

Blue in the Camps

Res	$\frac{31400 + 300}{200}$
Em7	178 — 180
C	16 /

Oaf 242 – 242

R ~~Th highoesinbanáe~~

C 16

Emit 179 – 179 *

R $\frac{31400 + 3000}{200}$

C 16

25

Em7	218–218 *
R	37650 + 8500 / 2000
C	16

Aut 198 – 198

R $\frac{37650 + 2500}{2\text{-}\ldots}$

C 16

27

Out 192 — 192

ℓ $\frac{37650 + 3500}{200}$

© 16

28

Ouit 221-221

R $\frac{34650+9000}{2000}$

C 16

29

Ault	205-206
R	$\frac{37650+6200}{200}$
C	16

30

EMT	203-203
R	$\frac{37650+5000}{200}$
C	16

Oct 21

Ramps. Marked. Light vacuum was put on at 9.10.clock

Oct 23

Received from lamp factory
19 new bulb, new made
and iron clamps.
Same carbons as lot 2
2 ditto but nickle
clamps, 2 old style,
nickel clamps 1 Sent
up before
Signed
Bachelor

Nov 3 1880

147
2
294

159
2
3)300
100
100
10000
443
300000
400000
400000

139)44380000(3407,
39
53
32
100
91

3407)33000(

8.8 oclock at 63.C

189 = 189

18870
5000
23870

busted at 8.37
was at 8.81
80
68
12

12) 68 (5.6
5.6
336
280
31.36
2
62.72

200) 23870 (119
20
38
20
187
180
7

159
2
378
126

119
52

119
114
714

119) 703310
5954
10680
952
1110
1071
300

(5892

5892) 33000 (5
29460
554

69.5
10.5

146 Volts

695
69.5
25

18870
5500
24370
121.85

1,8420
2
3.6840
2.0424
1.6424

8212
2
0424

44
2
88 candles

7922 ft lbs.

)33000
45185
38985

4.2
.6197
88 1.944
1.3642

367 per HP.

12500
3300
20) 15884
79

185
188

115
3)230
76
76
456
532
5776
44,3
17828
23104
23104
79) 2548768 (3228
2374
178
158
20
158
496
4745

322 sft

Lot 221 — 220

314
31
314
949
4

1760
3)5280
3
12320

Nov. 8 1880

{ 133-133

$$\frac{12580 - 1900}{200}$$ #5

$$\begin{array}{r} 133 \\ 3)\overline{266} \\ 88 \end{array}$$

C16

$$\begin{array}{r} 12580 \\ 1900 \\ \hline 20)\,14480 \end{array} \;(9$$

$$20)\,\overline{14480}\;(72 \text{ ohms}$$

This Lamp was coated at the clamps with carbon by being immersed in Kerosene..

$$72)\,342060\;(4764$$

$$\begin{array}{r} 288 \\ \hline 550 \\ 504 \\ \hline 466 \\ 432 \\ \hline 340 \\ 288 \\ \hline \end{array}$$

$$4764)\,33000\;(7 \text{ for}$$

$$33348$$

5

18870
300
19170 (9
2) 1917
110

6290
1700
2) 11390
56.9
2) 3980
19.9
6290
3400
2) 9690
48.4

18870
400
2) 19270 (96.6
1.270
20

6290
1490
2) 7780
38.9

12580
2800
2) 15380
76.9

15 12580
4800
2) 17380
86.9

12580
900
2) 13480
67.4

29.7

96
87
77
67.4
56.9
48.4
38.9
29.9
19.9

129 6
176

33 ~~~~~

4.2210794
1.6464037
7.7544873

3.6219704 flibo

6.3780296
4.5185139

0.8965435

7.9 HP.

113.
143

4.1061568
1.6464037
7.8446630

3.5972235

6.4027765
4.5185739

0.9213504

8.3 HP,

Lung 16

111 U
138 R

4.0906460
1.6464037
7.8601209

3.5971706 ft lbs

6.4028204
4.5185139

0.9213343

8.3 HP,

No 5: 139

Feb 8

Order 48 R 300
104 1/2 V. 4 (B)

120.15 V

1840
4500 R

200 / 23340 / 116

1340
1200
140

116 ohms

130
116
780
130
130

126
117
19 Ohms inserted.

120 / 15080 / 125
120
308
240
680
600
80

Order 48 R 285

100 ½ V 6

. 120.15 V

18840
3800 R

200 / 22640 / 113
200
264
200
640
600
40

48 C

136
113
390
130
130

123
113
10 Ohms inserted.

120 / 14690 / 122
120
269
240
290
240
50

103½ V or
7(A) 48 R 280

122.85 V

18840
3900 R

122740

48 C

200 / 22740 / 113
200
274
200
740
600
140

121
114
7 Ohms inserted.

130
114
520
130
130

123 / 14820 / 120
123
252
246
60

3.6521496
1.6464037
8.0969090

3.3954623
6.6045377
4.5185139

1.1230516 13.3 H.P.
at 16

3.5847834
1.6464037
8.0861861

3.3173732
6.6826268
4.5185139

1.2011407

15.82 H.P.

16.2.

3.5777502
1.6464037
8.0846002

3.3087541
6.6912459
4.5185139

1.2097598

16.20 HP.

9.9 1/2 V
14
order 48
R 275

116775

18840
3300R

200/22140/110
200
214
210
48C

130
111
130
130
130
117/14430/123
117
273
234
390
351
39

140
123
111
12 Ohms inserted.

Feb 8 order 144 R 285

111½ 1 7

121.50 ✓

18840 R
5000

200/23840/119
200
384
200
48 C

119 1840
130 1800 127
3570 40 119
119 8 Ohms inserted.

122/15470/126
122
327
244
830
732
98

Order 144 R 330

6 114½ ✓

130 ✓

18840 R 48 C
7500

200/26340/131
634
600
340
200
140

130
132
260
390
130

130/17160/132
130
416
390
260
260

Feb. 8, 1881.
Order 144 – R 290
29

121.50 V

18840
4300 R
23140

48 C

200/23140/115
200
314
200
1140
1000
140

124
116
8 Ohms inserted.

130
116
780
130
130
122/15080/123
122
288
244
440
366
74

Feb. 8, 1881.
Order 144 – R 270
99½ V – 26

114.75 V

18840
4000 R
200/22840/114
200
284
200
48 C
840
800
40

128
114
14 Ohms inserted

130
114
520
130
130
115/14820/128
115
332
230
920
920

Feb. 8, 1881.
Order 144-R295
111 1/2 V-9

124.83 V

1884.0 R
590.0 R

24740

48 C

200/24740/123
200
474
400
740
600
140

130
124
520
260
130
125/16120/128
125
362
250
1120
1000
120

129
124
5 Ohms inserted

Feb. 8, 1881.
Order 144-R250
28

118.12 V

1884.0 R
430.0 R

200/23140/115
200
314

48 C

200
1140
1000
140
140

130
116
780
130
130
118/15080/127
118
328
236
920
826
94

128
116
12 Ohms inserted

Feb. 8, 1881.
Order 144 - R 230
4

118.12 √

18840. R
2700 R

200 / 21540 / 107
200

48 e

1540
1400
140

108
130
3240
108

119
108
11 Ohms inserted.

118 / 14040 / 118
118
224
118
1060
944
116

Feb. 8, 1881.
Order 144 - R 290
111 V - 18

124.83 √

18840 R
6200 R

200 / 25040 / 125
200
504
400

48 e

130
125
650
260
130

1040
1000
40

130
125
5 Ohms inserted.

125 / 16250 / 130
125
375
375
0

Feb. 8, 1881.
Order 144 - R 310
6

120 ✓

18840
5200 R
24040

48 C
200/24040/120
200
404
400
40

130
120
2600

130
130/15600/120
130
260
260
0

Feb. 8, 1881
Order 144 - R 260
22

118.12 ✓

18840 R
4500 R
200/23340/116
200
334
200
140 C

1340
1200
140

130
117
910
130

129
117
12 Chusimertoo.

130
118/15210/128
118
341
236
1050
944
106

Feb 8

112 ½ V

or 144 R 240

122.83 V

18840
3300 R

22140

48
200/22140/110 R
200
214
200
140

117
111
6 Ohms inserted.

130
111
130
130
130
123/14430/117
123
213
123
900
861
39

or 144 R 270.

103½ V 27

118.12 V

18840
3800 R

22640

48
200/22640/113
200
264
200
640
600
40

125
113
12 Ohms inserted.

130
113
390
130
130
118/14690/124
118
289
236
530
472
58

Feb. 8, 1881.
Order 144
3

1112 V

18840
5000 R

23840

48 C

200/23840/119
200
384
200
1840
1800
40

130
119
1170
130
130
118/15470/131
118
367
354
130
118
12

131
119
12 Ohms inserted.

Feb. 8, 1881.
144 - R 340
116 V - 15

130 V

25127
3700 R

28827

48 C

200/28827/144
200
882
800
827
800
27

130
144
520
520
130
130/18720/144
130
572
520
520
520

Feb. 8, 1881.
Order 144 - R 305
2

122.85 ✓

1840 ✓
5600

200/24440/122
200
444
400
440
400
40

48 C

130
122
260
260
130
123/15860/128
123
356
246
1100
984
116

129
122
7 Ohms inserted.

Feb. 8, 1881.
Order 144 - R 225
106 V - 23

114.75 ✓

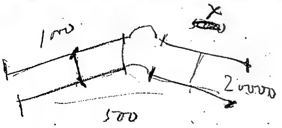
2800
1840 R
21640

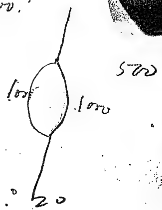
48 C

200/21640/108
200
1640
1600
40

122
108
14 Ohms inserted.

130
108
1040
130
115/14040/122
115
254
230
240
230
10





1000 ohms,	1000, ohms

49 1 : 20 1 : 20
20 : 1 1000
:988

R : R' :: e' : c
1000 : 20000 :

$$\frac{x-3}{x+2} = \frac{1}{\cancel{4}}$$

$$\frac{4}{4x+8}$$

$$4x \cancel{-12 = x+2}$$

$$3\cancel{x}$$

$$\frac{x-3}{x+3} = \frac{1}{4}$$

$$4x - 12 = x + 3$$

$$3x \quad \overline{)15}$$

$$\underline{5}$$

$$8$$

$\frac{x}{y}$ $\qquad \frac{x-3}{x+3} = \frac{1}{4}$

$4x - 12 = x + 3$

$3x = 15$

$x = 5$

$x + 3 = 8 \qquad \frac{5}{8}$

$\cancel{\frac{(x-3)}{x}}$

$\cancel{\frac{x-3-3}{x} = \frac{}{4}}$

$\frac{-3x-6}{x} = 1/4$

$\cancel{1/4x + 3x = 6}$

$x + 3 =$

$\frac{x-3}{x+3} = 1/4$

$1/4x + \frac{3}{4} = x - 3$

$5x = 15$

$5/4x = \frac{15}{4} \qquad x = 3$

Menlo Park Notebook #123 [N-80-08-17]

This notebook covers the period August 1880. Most of the entries are by William J. Hammer. There are also a few entries by Francis Jehl. The book contains notes, along with a few drawings, relating to tests of experimental lamps. The label on the front cover is marked "Hammer" and "Experimental Lamps." There is an index on the inside front cover. The book contains 284 numbered pages.

Blank pages not filmed: 26-35, 40-197, 200-269, 272-279.

Page	Lamp	Page	Lamp	Page	Lamp
1		13	803		
2					
3.	1421	13	Depot Lamps		
also 3 11	1424				
3	1382	13	748		
3	1427	13	420		
also 5 15	1384	13	311		
5	1396				
5	1428	15	484		
also 5 11	1380	15	468		
7	1360	15	1384		
also 7 11	1435				
7	1420	15	334		
7	1406	15	1331		
9	1433	17	1422		
9	1410				
		18	1445		
11 also 3	1424	19	1437		
also 7	1435				
also 5	1380				
13	331				
13	802				
13	Lead glass no nos				
13	176				
13	754				

1

Experimental Lamps
EDISONS LABORATORY.

"Experimental Lamps on Pump Line."

1421. 48 Candles, shunt of 11 ft - 22 Ohms,
Put up on pump line Aug 17 - 1880 - 10.55 A.M.
Carbon slightly curved and clamped the new way flat side out - 4 hours 10 min.

1424. 48 Candles, Shunt of 10 ft - 20 Ohms,
Put up on pump line Aug 17 - 1880 at 11.00 A.M. Carbon nearly straight, was clamped the new way. Broke just above the shank at 3.30 P.M. having lasted - 3 Hours 30 min - globe discolored

1382. 48 Candles, Shunt of 5 ft - 10 Ohms
Put on pump line Aug 17 - 1880, at 11.00 A.M. Carbon slightly curved & broke 3/4 ways up. was of old style clamping
Lasted = 1 Hour 45 min. - globe discolored

1427. 32 Candles, Shunt of 8 ft - 16 Ohms
Put on pump line Aug 17 - 1880, at 11.12 A.M. Carbon slightly bent & broke half way up. Having lasted to 2.15 P.M
- 2 Hours 13 min.

"Experimental Lamps on Pump Line"

1384. 48 Candles Shunt of 8 ft 1.6 Ohms.
Put on pump line Aug 17-1880, 11.05 A.M.
Carbon (bent considerably after being
up a couple of hours, was clamped
in the old way. taken down by order T.A.E.
to test 9.15 lasted 8 Hours. 10 min

1395. 48 Candles, Shunt of 7 ft 14 Ohms
Put on pump line Aug 17-1880, at
11.05 A.M. (Carbon slightly bent, broke
half way up, Carbon clamped in the old
way, inside of globe quite discolored.
broke at 2.18 P.M Having lasted 2 Hours 13 min

1428. 32 Candles, Shunt of 8 ft 16 Ohms
Put on pump line Aug 17-1880, at
11.10 A.M. Carbon slight bent both ways
(broke about half way up, was clamped
the new way, went out 3.10 P.M having
lasted 3 Hours.

1380. 32 Candles, Shunt of 10 ft
20 Ohms, Put on Pump Line Aug
17-1880. at 11.15 A.M. Carbon slighly bent
(was clamped in the old way, Carbon broke
just above shanks, Aug 18 '80 at 8.10 lasted 11h 55 min
having good vacuum

"Experimental Lamps on Pump Line".

1360. 32 Candles, Shunt of 11 71-22 Ohms, Put on pump line Aug 17 at 11.15 A.M. Carbon curved much more after being up a couple of hours, in fact till it touched the glass making a blister and making the inside iridescent about 1.50 P.M. the carbon broke at point of contact and split nearly the way up. lasting 1 hour - 35 min.

1435. 32 Candles. Shunt of 15 71-30 Ohms, Put on pump line Aug 17-80 at 11.30 A.M. Bulb made of German glass, Carbon perfectly straight clamped in new way, Carbon broke near shank at 8 A.M. Aug 17 - good vacuum lasted 11.30

1420. 32. Candles, Shunt of 15 71-30 Ohms, Put on pump line Aug, 17-1880. at 11.30 A.M. There was a slight spot on carbon half way up at which point it broke at 2.50 P.M. Having lasted 2 Hours 20 min. new way of clamping.

1406. 32 Candles, Shunt of 18 71-36 Ohms, Put on pump line Aug 17-1880. 11.30 A.M. Carbon clamped in old way. Broke, at 3.30 P.M I think there was an arc at clamp, glass was broken where the wire is sealed in, It lasted - 3 Hours. -

All these lamps had a poor vacuum J.H.E.

1433. 48 Candles, Shunt of 3.81=6 Ohms
Put on pump line Aug 17-1880, at 11.30 A.M., Carbon broke just above the shank, at 1.45 P.M. Having lasted 1 Hour 15 min, Clamped in the new way

1410. 32 Candles, No Shunt,
Put on pump line Aug 17-'80 at 11.37 a.m. Lamp burst at 11.48 A.M. having lasted but 11 min do not know which way carbon was clamped

Picking out the good lamps according to George

1424 48 Candles 210 minutes

48 candles 105

48 candles still on

this lamp was taken off by order of T.A.E. 133

$\boxed{448}$

112

1435 32 candles still on broke after 11.30

1380 32 candlestill ~~on~~ " " " 11.55

32 candles " "

32 " " 180

915

~~No 331 Old street lamp~~

~~Fair vacuum~~

No 331 Fair vacuum {glass around the clamps

No 8 802 Poor vacuum (glass not around the wires.

Lead glass Moderate vacuum (glass not around the wires)

No 176 Fair vacuum (glass around the wires

No 754 Fair vacuum (No glass around the wires)

No 803 Fair vacuum (glass not around the wires)

Depot lamp { Very high vacuum
glass around the
platina wire

No 748 — Good vacuum (glass not on wires

{ Lead glass very good Vac,
No 420 White lead (glass around the wires)

No 311. good vacuum
glass around the wires

~~No 383 Poor vacuum.~~

484 { high vacuum
white lead glass.

glass about the wires.

468 good vacuum
glass not around the wires.

1384 good vacuum
This lamp was taken off the pump line + broken to test by T.A.E.
— no glass around the wires —

No 334 quite high ~~good~~ vacuum old lamp.
glass around the wires
thus burnt 14,000 hours

No 1331 good vacuum.
taken from pump line

No 1422 Hung on pump line at 7.15 P.M. Aug 17-1880. Carbon broke near curve Aug 18-80 - 8.25 A.M. having lasted 6-10 min

Very high vacuum as it was sealed off when the engine stopped for all night.

No 1445

20=32 Em 7.225

13 ft for 32 C

~~[illegible]~~

Good Carbon

put up on pump line.
7.40 P.M. Aug 18-80
The lamp arced at the
clamps, and broke
at 8.40 Having
lasted
1 Hour

The clamp was fused into
a pellet which dropped
down into the point of
the lamp. shattering it
noticed a pellet of plati-
-na on the shank of the
carbon. which broke only on one side

No 1437

Carbon Slightly bent

It required five feet for
to make it 32 E.M.7
~~Em 7 for~~ L. 227 R 228

put on the pump-line
at 8.45. P.M., Aug 18-80
this was not a bit blue at the
clamps. Went at 11.
Lasted 3.45

broke half way up the
side.

No: 1441

Marked Low Vacuum
Carbon bent, and bright spot at one of The clamps.
five feet to make it 32 C

E M F. 226 L. 227 R

This lamp broke at clamp after being up but a few minutes.
Aug. 18 – 80.

[illegible]

No 1442

Carbon Slightly bent
Wanted 15 ft for 32 C
228 L. 228 R.
Clamped the ~~the~~ [illegible] [illegible] put on pump line —

No 1443

Good Carbon.

Required 8 ft for 32 C

EMW7, 229 R 229 S

Bad spot at the Clamp

8 feet for 32

EMW7, 230,

Carbon [illegible] [illegible]

Clamp [illegible] [illegible] [illegible] may

[illegible] [illegible] the pump

[illegible] —

No 1399

Carbon Bent

It required 15 ft for 32 C

EM(7) 229,

put up on pump [illegible]

— old.ring of clamp [illegible]

No 1396.–

Carbon broke half way up, ran about ½ hour

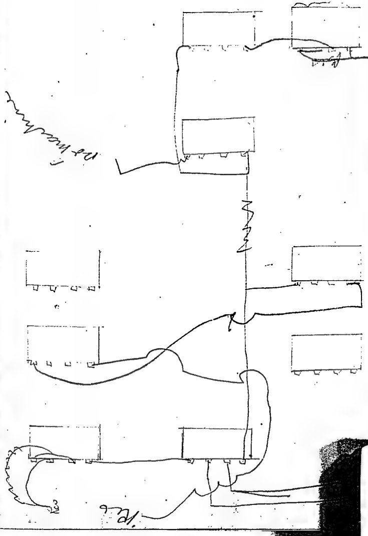
Noticed that almost all of these experimental lamps are considerably discolored on the inside even though up for a short time.

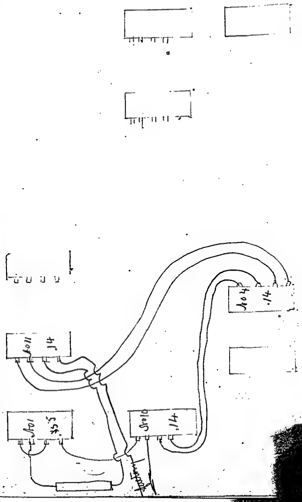
Old way of [illegible]ing.

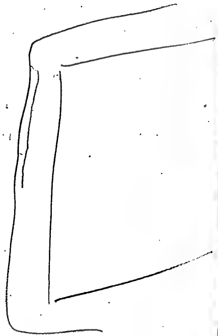
No 1446 –

Hung on pump line

Carbon nearly straight –







365
365
365
4015
2087 45

1

$$\begin{array}{r} 25 \\ 8. \\ \hline 200. \\ 5 \\ \hline 1000 \end{array}$$

47 . 2 .

$$\begin{array}{r} 470 \\ 300 \\ \hline 41000 \end{array}$$

14000

1000.

10

$$\begin{array}{r} 1400 \\ 100 \\ 20 \\ \hline 1520 \end{array}$$

4 8

47
4
188
47
47 - 1000.
8 80
$2\frac{1}{2}$
20.
40
10
400
24
300
7200
12
40
480
300
30
20

1685
350
280
2315

25
5
125
10
1250

1250
300
375,000

200 / 375,000
187.
5
935.
750
1685

250
300
75,000

25. 1000
1200
500
2700

3000
3500,

Menlo Park Notebook #124 [N-80-11-18]

This notebook covers the period November-December 1880. Most of the entries are by Francis Jehl. A few entries appear to be by Francis Upton. The book contains notes and calculations relating to tests of experimental lamps. Included are tests of bamboo, bast, paper, and gasoline-treated carbons. The label on the front cover is marked "Lamps Lot D" and "Francis Jehl." There is an index on the inside front cover. The book contains 284 numbered pages.

Index.

197° – 198° = 16 candle

R 31406 + 5000

200

Nov 16

34°

10 35° = 34° C

264
54
320

3 48
35
13

7 3.6 grains

Index.

Analysis of Lamps tested — 23, 25, 27, 29, 31, 55, 173

Bamboo and Bass Carbons Tested — 1, 6, 7, 15, 17, 19, 21, 23, 25, 27, 33, 35, 37, 41, 43, 45, 47, 49, 51, 53, 63, 65, 67, 71, 73, 75, 77, 85, 87, 91, 95, 99, 101, 103, 105, 107, 109, 111,
" 113, 115, 117, 191, 120, 121, 123, 125

Paper-Wood Carbons tested — 79, 81, 83.

197° - 198° = 16 candle

R $\frac{31406 + 5000}{200}$ Nov 16

34°

10.35° = 34° C = 93 1/5 F

10.48 50.3/4 C

vessel lamp + water 1056

vessel + lamp 261

lamp 59

261
59
320.

1056
320
736 grains

348
35
13

50.75
34
16.75 @

736 gm
15.43

13) 37717.65 (2901.3 ...

2901) 3390.0 (1.1

736
15.43
2208
2944
3680
736

7000) 11356.48 (1.62 lbs
7000
43564
42000
15648
14000

1.390
1.62
2780
8340
1390
225180
16.75
112590
157626
135080
225180
377176500

736

197
198
3 | 395
132 V
182 R

31406
5000
200) 36406 (182
200
1640
1600
406

182) 772020 (4
748

3
182) 772020 (4241
728
440
364
762
728
340

Batten 32 — 62

Def 192 — 6 196 = 16 C

42.3

3 or 6 oclock!
4.16
195 — 196

234
2
───
3 | 468
156 5

Time
(3.5 6')(1)
(4.1 6')(2)

Def 195–196

42.3 7°
92.1 7°) Temp

weight with vessel + water
1286.5
417.5
───
869.0

Lamp 58
vessel 202 1/4

1565 feli

52. C. 4.45.5.15
JSB
14

17
6 3
2 4

17$\cancel{0}$)1078091(6335
102
58
51
60
51
99 4 3

38445.6
.19.1

22456
34607.04
3624 56

20) 7340 1.0.4.6 (3471

44 3672

4
3
11

.0471) 3439 (9.5.

17610

92.17
42.37

49.87

772
496
3486
3486

3844 50.6

869 gms
15.43

2607
3476
4345
869

7000) 13408.67 (1.91

64086
6300
40860

.869
2.2

1738
1738

1.911 8.

$$2\overline{)4.9.8}$$

2.49 per minute

1.91	0.2810
2.49	0.3962
775	2.8893
	3.5665

3685

These figures were on cover of this book.

$\frac{5}{9} + \frac{160}{9} = 34$

$$\begin{array}{r} 34 \\ 9 \\ \hline 306 \\ 160 \\ \hline 5)\overline{466} \\ 93.5 \end{array}$$

180

170

Nov 18

(lamp marked 3 hours but 217/7)

179 - 179 EMF (400)

$$\begin{array}{r} 25127 \\ 3400 \end{array} \quad 3)\overline{358} \quad 119$$

20)28527(142 Res
20
85
80
52

Hg in the glob,

Put up at 3,40 Nov 1880

Lamp old style (now 290) *

207 - 207 EMF.

37687 + 700
  700

20)38387 (191 Res.
  20
  183
  180
  3

$\frac{207}{3)414}$ 138

No 1 6

Put up at half past two Nov 18/88

Nov 18

17

18

26.5

25

\$380) 33000 (7.5
30660
23450

(Lamp 460 down to 222)

178 - 178 E M F. *

2512
3500

20) 22627 (~~1100~~ Res
20
162
160

(2.86

143 ohms

178
178
(356
119

178
3)356 2 2
118

143) 627330 (54380
~~4285~~
572
553
429
1240

Put up at 16 at 2.30. nov 18 1880

218

204 – 209

37687
6200 R

209
2
3(418
139

16

Large marked (350 ohms)
old style 12 Bamboo 115 ohms

2) 43887 (219
40
35
35
188
180

135.63) 670210.00 (~~7~~ 4930
~~67815~~
54252
127670
123067
46230

4930) 33000 (6.6
29580
34200

17
571
29

Nov 19
Lamp marked " Basti Plat
Clamp 5 hours Carbonization
Extra high heat. " " without C
but partial vac 314 with C
21.5 Pr. " " Previous 305"

185 - 185

185
185
370
123

25127 + 2000
25127
27127
135.63

16

190 - 190

25127 + 1700

Put on at 2:30 at 16 C

On Sunday Nov 20 1880 1 oclock

163) 616830. (4150
592
248
163
850

4150) 33000 (

Nov 19

"Blue on Plat wire" = Now after
2 hours 250" "Best Plat Clamp
5 hours carbonization Extra lights
Heat " "Prew over] 3011

177 177

31406 + 1200

31406
1200
32606
163.

16 . 16

177
177
354
118

Put on at 2.30 at 16C

1032)395000 (3820
3096
8540
8256
2840

3820)33000 (8.6
30560
24400

143 - 144 Emf,
17560
1500
2|19060
95. Ohms at 22 C
138 - 138
12570
6700
2|19260
96

Nov 19

48 candle for hour after
spark went Res 170"
Bast - Plati clamps 5 hours
carbonization Extra high heat
Res 250

142 - 142

18840 + 1800

16

18840
1800
20640
103.2 Ohms

142
142
3|284
94.6 Volts

see page 55

Put on at 230 at 16 C
on Sunday measured again same EMF
same 22 C

1207) 460900 (3820
3621
9880
9648
2320

Nov 19

48 Candle for 1 hour after spark went left R 191
Bast Plat Clamp 5 hour carbonization Extra high heat = Drew 285

16 C

153
153
306
102

18840
5300
24140
120.7

Put on at 2:30 at 16 C

117.45)469980(4000
46980
1800

4000)33000
8.25

Nov 19

186 ohms Cold
T.A.E 4 hour lamp
5 hour ordinary heat

18840
4650
2)23490
117.45

155
155
2)310
103

114 — 114 Nov 19/1880

12560
3000
2)15560
77.8

114
2)228 3323.
76.

77)255880 (3323.
231
248
231
78
54

This land was put up at 1.6
at 3.20 Nov 19 1880

Sunday Nov 20 1887

Tested Lamp on page 29 of this book.

The lamp at 143 EMF, was 22 C, yesterday at same EMF it was 16 C.

151 - 151

18840
3700

2 | 22540
112.

151
2
3 | 302
100

16 C.

112) 443000 (3955. ft lbs at 16 C
336
1070
1008
620
560
600
560

18840
3400

2 | 22240
111.

157
2
3 | 314
104

22 C

111) 479150 (4318 ft lbs at 22 C
444
351
333
205
111
940

Sunday Nov 20 1880

Tested hemp of page 27 of this book. at 10 C

18840
400
2 | 19240
96.

140
2
3 | 280
93

96) 383150 (3991 lbs
288
951
864
875
864
110

at .22 C

2 | 19040
95) 425460 (4475 lbs
380
454
380
740
685
550

148
2
3 | 296
98
2

4475) 33000 (7.3
31325
16[illegible]

3991) [illegible] 8.5
28

5991) 33000 (
31428
2072

18 3991
3[illegible]

399) 2072
199[illegible]
0.77

Nov 21 1880

183 — 183

25127

16

Bad 5 hour
Reg vac proves
1 hour no spark
Now 167
440 R [illegible]

183
3)366
122
125

5274.

2)25127
125.

125) 659360 (5274,
625
343
250
936
875
610

This lot of lamps were
put up at 5.20. Nov
211 up to page 53

Ed#171 171

R, 18840 + 6000

16

(Boost 5 hours Reg v
Process 1 hour no spark)
191 Pres 50,8

18840
6000
2 | 24840
124

171
3 | 342
114 O
124 R

124) 57572 0 (4642.
496
797
744
532
496
360
248

Nov 21 1880

163 — 163

18840 + 4700

1.6

Burst 5 hours
Reg & Process
1 hour no spark
184 Prev 543

163
2
3|326
1080
127 R

18840
4700
2|23540
127

117)51672.0(4416.
468
487
468
192
117
750
702

151 - 152
18840 + 4500
16

1 other high vac
spark gone
Process 491. now 182

151
152
3 | 303
101
116 Res

18840
4500
2 | 23340
1.1.6

1.16

116
8
28
44

45490
3484
1039
928
1110
1044
660
80

(~~4~~3895.

165 - 165

18840 + 8000

16

after hour. 2 part gone
217 cold originally
455 alms

$$
\begin{array}{r}
165 \\
\underline{2} \\
3\,)\overline{330} \\
110 \\
134\,R
\end{array}
\qquad
\begin{array}{r}
18840 \\
\underline{8000} \\
2\,)\overline{26840} \\
134
\end{array}
$$

134) 5360 30 (4000.
030

3:

80
72
8)72(9
72

Nov 21 1880

153-153
18840 + 3600
16

Burst 5 hours
by vac process
1 hr no spark
175 Prev 466

Put on at 81 C at ~~2.5~~ 3.05 o'clock
~~busted 3.05~~

153-153
3|306
102
109 Res

18840
3100
2|21940
109

109)460900(4228
436
249
218
310
218
920

165 - 165

25127 + 400

16

Boat 5 hour

Reg process 1 hr no.

Park 202

165	25127
3)330	400
1105	2)25527
127 Res	127 R

[redacted] 127)53630 (4220

280

254

263

254

09

4220) 33760 (8.

Lamp Ad lamp on page 29
Page The Same.
27 put on at 230 Nov 19 1880

2.30 Nov 19
12. Nov 20 Sunday
Monday

)350900
355839
122.7) 356000 (2900
2454
11060
9802
1258

2900) 33000 (11.3
2900
4000
2900
11000

Gasoline carbon has been

15 candles

135 L
135.5 R.
133
(2695
89.8 Volts
18840
5700
(24540
122.7

Batteries
33 R
31
64

9638
9638
6464
9140
4880

3070

307

5185
4880
.0305

10.7 per H. P.

Gasoline

16 candles

137
139
276
92

18840

5550
24390
121.9

117.7) 555700.0 (4720
47088~~4~~
8490
8239
251.0

4720) 33000 (7.
33040

48
7
336

Gasoline

48 candles

165
170
335
112
18840
4700
23540
117.7

127.2) 529000 (4160
5088
2020
1272
7480

4160) 33000 (8.

Regular Nov 23

16 candles No. 1
fusted

162.5
167
329.5
109.8

18840
6600
25440
127.2

95.2) 418.000 (43.90
3808
3720
2856
8640

4390) 33000 (7.5
30730
22760

Regular No 2

148
145
293
97.6

18840
200
19040
95.2 Ohms

$$119\overline{)\,4.72000\,}\,(4000$$
$$4768$$

$$4000\overline{)\,33000\,}\,(8.25$$
$$32$$
$$10$$

Regular .017 X .010 Bursts

Nov. 23 Marked No. 3.

153
157
310
103.3

18840
5000
23840
119.2

151
155
306
102

18860
4100
22960
1.148

96.5) 457 (47.3
~~60~~
3866
7100
6755
3450

47.3
216
2838
473
946
102168

115) 462 (4010
460
200

Reg Bast
0".010 X 0".017
Exactly 16 candles

227 L
230 R
3(457
152

18860
4140
23000
115

531 2.7251
96.5 8.1155
1.3345
119 2.0751
2.0751
1.8464
7.9749
3.7715 5910
4.5185
.7470
5.58 1.6812
2.4282

268 candles per H.P.

Reg Bast
1510X017

48 candles

265
266
531

18840
2350
2)21190
105.95

108
20
216 volts

96.5) 449.5 (465
386.0
6350
5790
56.00

465
216
2790
465
930
100.440

~~484~~

111.3) 447000 (401.0
4452
1800

Reg. Bart
After 48 candles

16 candles

222.5
227
449 5

1884.0
3420
222 6 0
111.3

Battery

47 R
49.5
96.5

Present reg. Band 1.8 X 10.5

Old .17 X 8

28.5 : 25 :: 16 : 14.03

```
 2041
 3979
 5452
-----
 1472
```

```
3740   3.5729
       1.1461
       ------
       2.4268
       1.2041
       ------
       3.6309
4270
```

~~336~~

96.5	1.9845
21.6	1.3345
	.6500

8
$3\frac{2}{3}$
$11\frac{2}{3}$

2.5263
.6500
1.8763
1.8763
1.6464
8.1175
3.5165

3280

Nov. 24, 1880

Old paper loops very much bent

8 candles broadside edge
$3\frac{2}{3}$ in

170 L
167
168 R
336

Battery
47 R
49.5 L
96.5

12560
2700
15260

.7630 Ohms

2,5635
6500
1.9135
1.9135
1.6464
8.1302
3.6036

4010) 33
8.2

Old paper same as page 79

16 candles

185 L
181 R
366

12560
2270
14830
74.15

2.6395
.6500

1.9895 9.7612
1.9895
1.6464
8.1530

3.7784

6000 | 33000
5.5

.7404
1.6812

2.4216

264 candles per H.P.

old paper

48 candles Flashing blue in globe

217 L
219 R 6

3|436
19

12.560
.1500

14060
70.30

50 minutes

at 5-5

6-30 taken off

Bamboo Hige Vac

16 candles

270
270

25127
3950
29077
145.38

31406
3950
~~27456~~
35356
176.78

117

2.6681859

2.7218 4.1068718
.6500 1.4 2.710

2.0718
2.0718 117 Volts
116.64
~~7.8368~~ 1368.58
~~3.626 8~~ 4230
7.757 ~~2~~ 13689.
~~3.567.2~~ ~~3690~~
~~4.5185~~
~~.9513~~ 1185

~~8.94~~

3:5420 3480
4.5185
:9765 9.47 per H.P.

Regular Bamboo

16 candles

265 L 47 R
282 R
527

117 : 4.
~~25.27~~ 117
~~4000~~ 819
~~29.27~~ 117
~~145.65~~ 11.7
13689 1
31406
4000
35466
17703

~~2.7340~~ 2.6454
~~.6500~~ .6500

99 1.9954
1.9954
1.1664
7.9056
3.5428

3490

Turbine
16 to 17 candles

222 L
220
~~542~~
442

18840
6020
24860
124.3

2.4150
6500
1.7650
1.7650
1.6464
7.6055
2.7819

605 ft.lbs.

Bamboo .050
6.
.30
.24

Lamp visible ~~yellow~~ red

132 L
128
260

37687
11900
49587
247.935

Pt. clamps 5/8 long 1/16 .125

.040 thick

.62
.16
362
62
.9982

.160
.62
.2
.120

.0625
2
.125
8
.1200

~~Gasoline~~ Nov 24 1880

162 162

$$\begin{array}{r} 162 \\ 3\,)\overline{324} \\ 108 \end{array}$$

25127 3400

16

$$\begin{array}{r} 25127 \\ 3400 \\ \hline 627 \end{array}$$

$$2\,)\overline{28527}$$
142 R

142
52

142) 516720 (3638 F.P.
426
907
852
552
426
51260

3638) 33000 (9.7 HP.
32742
2580

Burned for 3 hours at about 70 C.

67.75 lunch

68.25

11.75

1.8340
2
3.6680
2.1422
1.5258
3010
1.8268

1.0711
2
2.1422

1.0682
19
1.0701
2
2.1402

67. 3.6682
2.1402
5280
3010
8290

67.4 candles

194 = 194.

132
5
660

194
194
3 | 388
129 V

25127 + 1300

25127
1300
2 | 26427
132 R

132) 737200 (5584
660
772
660
1120
1056
640

5584 ft lbs

5584) 33000 (5.9
504

62
5.9
558
310
3658

16.2
21.6

~~2.0128~~
~~1.3284~~
~~.6844~~

2.0531
1.3284
.7247
.6844
.0403
2
.0806

593.

2.7731
.6844
2.0887
2.0887
1.6464
7.8630
3.6868
.0806
3.6062

~~4000~~ ft lbs

4040.

Lamp 15 D

Bast 17 X 10

5 hours carbonization

16 candles

295 L.
298
593

25,127
2300
27427
137.13

Batteries 58R
55L
103

2.7050
~~6~~844

2.0206
2.0206

1.6464
7.9998

3.6874 ~~4660~~
.0806

3.6068 4050 ft lb

Lamp 16 D

10 X 16 Baist Reg
16 candles :

250
257 R

507

18840
270

20010
100.05

2.7316
.6844
2.0472
2.0472
1.6464
7.9176
3.6584 ~~4550~~
.0806
3.5778 3780
.5185
9407 8.72

Lamp 17 D

16 candles

265 L
274
539

18840
3350
22190
1 10.95

2.7324
.6844
2.0480
2.04 80
1.6464
7.9521
3.6945 ~~470~~
.0806
3.6139 4110
.5155
9046 8.03

Lamp 18 D

10X17 Bast

266
.274
540

18840
3500
22340
111.7

2.8267
.7247
2.1020
2.0020
1.6464
7.9200
3.7864
.5185
7381

126 Volts

6030

5.46

Lamp 190

10X17 Back Bad Spot in it

16 candles Blue at clamps

333 L
338 R
671

18840
4650
123490
117.45

1.7364
.7247

1.0117
1.0117
1.6464
7.9570

1.6268 4230
.5185

8907 7.77

Lamps 20

10 X 17 Bast

16 candles

271 L

274-275

545

18840
3400

22240

111.2

2.8182
.7247
2.0935
2.0935
1.6464
7.9487
3.7821
.6185
.7364
2041
9405

6050

5.45 lamps per H.P.

87.4 [illegible] per H.P

Lamp 21

10X17 [illegible]

15 candles

328
330
658

18840
3650
22490
112.45

```
2.7709
 .7247
 -----
 0462
 0462
 6464
 9052
 -----
 6440        4400

 5188
 6440
 -----
 $705        ~~57~~
             7.42
```


Lamp 22

16 candles

```
295 L
295 R
-----
590
```

```
 18840
  6000
 -----
 24880
 -----
 124.4
```

busted on Nov. 28 1880 at about
Lines. Addl.

.7076
7247
.9828
9829
6464
9676
5798 3800 [illegible]
5185
9387 8.68 per H. P.
2041
1428 139 candles per H. P.

4.2608978
1.6464037
7.9706162
4.0779177

1196.51

Lamp 23

253 £ 16 candles
257
3)510
170

18.840
2700
21540
1070.7

170
170
11900
170
28900
1443
86700
115600
1156
107)12802.70.0(119
107
210
107
1030
963
670
42

5½ ~~times~~ Webers the current required on Maxim

~~3/4~~ 4/3 X 5.5
4
(22.6
7.3 times the current

134 candles per H.P.

12 candles
16
9.5
80
144
15.6.

$$7\text{t.lbs.} = c^2 R$$

$$\frac{7\text{t.lbs.}}{R} = c^2$$

$$R = \frac{7\text{t.lbs.}}{c^2}$$

$$\frac{1}{7.3}$$

.8633
.4316
.5684

2.2430
5684
1.6746

47 Ohms

Dec 6 1880

16^D up to Dec 6. 6 PM. 139 hours (th Busted on Dec 15 1880)
17^D " Ditto busted 178
16^D Ditto busted on Dec 15 1880

Reg No 6 211 hours

Nov 25 1880
11.25 P.M.

15^D Nov 28 at 10 am
16^D
17^D busted at 4 PM Dec 8
18^D 6
20^D 5 PM. 28 Nov 1880

22^D busted on Nov 28 at 11 am 1880
23^D busted at 5 PM Nov 28

$$\begin{array}{r} 137 \\ 32 \\ \hline 171 \end{array}$$

79.8) 199.5000 (2510
1596
3990
3900
900

2510) 33000 (13 ~~per~~ H. P.
2510
7900

1.8260748
2
3.6521496

6 - 6
7   15/12
8   67

13
16
78
13
20 6 candles per H.P.

1.65
5.5
280

Half length Bamboo
3"

16 candles Battery
32 L
32 R

100 L
102 R

3202
67
67.3

1.2560
3400
15960
79.8 ohms

Put on at 16 C at 11 am
~~Dec~~ 3 1880
Dec 13. 18 hours Black on the globe
up to Dec 6. 6 PM. 37 hours
Broke at Dec 8. at 1 PM.
75 hours

82.3) 164950 (2000
1646
350

216
217
433

184.5 : 433 :: 82.3 : 193
82.3
1107

2.63649
1.91440
7.73401
2.28590

4000) 33000 (8.25 per H. P. of 17 candles
32000
1000

2012) 33000 (16.4
2012
12880
12072
7080

Half length carbon

8 1/2 candles

91.5 L

93 R
184.5
61.5

15960
500
16460
82.3

61
61
61
366
3721
443
11163
14884
14884

82) 1648403 (2012
164
84
82
203

143.13
14) 5263300.00 (0367
42939
96940
85878
110620

3690) 33000 (

0374
0374
6464
8447
5659
5165
9516

3680

8.9

Regular No. 1.

Dec 3 1880

32.5 R
31.5 L

162 L
165 R
327
109 25127
3500
28.627
143.13 Ohm

143 : 109 :: 143 . :: 143 + X

109 : 143 : 143 . 143 + Y

15042) 5300300 (35.20
45126
78770
75216
3560

3520) 33000 (9.3 per H.P
31680
13200

214
2
3)428
142

.0434
0434
6464
8225
5557 3600

Regular No. 2
Dec. 3. 1880

165 L
167 R
332
110.6

25127
5000
30127
15042

181.5) 866280 (4780
7260
14228
12705
15230

No 4 Regular

11 candles

210 L

31406
4900
36306
181.53

169)744000 (4400
676
680
676

No. 3 Regular

Dec 3 1880

16 candles

194 L
195 R
389
129.6

31406
2400
33806
169.03

1205

178 Rs

2.0791812
2

4.1583624
2.2504200

1.9079424
1.6464037

3.5543461

3.5838

120
120

2400
120

14400
443

43200
57600

5760

178) 637920.0 (3583
534

1039
890

1492

x y
y y
z z

9(x+y)

7(y+z)

~~8y~~ 8x−8y=x+y

$3\,4\,4\,4$

$$368 \overline{)\,198054}$$

1840

1405

$$\begin{array}{r} 2304 \\ \times\ 86 \\ \hline 13824 \\ 18423 \\ \hline 198054 \end{array}$$

$$\begin{array}{r} 58 \\ 7 \\ \hline 406 \end{array}$$

$9x+9y = 7y+7z \quad = 9x+2y-7z = 0$

$8x-8y = x+z \quad 7x-8y-z = 0$

$x+y+z = 1152 \quad x+y+z = 1152$

$9x+2y-7z = 0$

$72x+16y-56z = 0$

$14x-16y-2z = 0$

$86x-58z = 0$ (1)

$$\begin{array}{r} 86 \\ 9 \\ \hline 774 \end{array}$$

$9x+2y-7z = 0$

$2x+2y+2z = 2304$

$7x - 9z = -2304$

$86x - 58z = 0$

$\cancel{7(86x\ x)}$

$7(86x) - 774z = -198054$

$86(7x) - 406z = 0$

$80 \quad 368z - 198054$

16273
436

38
9

9541
9463

9541 8
9463 8

9
78
24

4.2114676
2.6344865
310
6.8509541
24
18

7095028

10

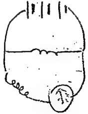
7095028

50
7095028

$\mathcal{E} =$

$C =$

$$C = \frac{\mathcal{E}}{r + \frac{S(P+g)}{S + (P+g)}}$$



S P+g

Bat Res = $r = R - (2P + \text{gal})$

$r = R - (2P + \text{gal})$

$2 \Omega R = 2P + g$ $\quad \frac{R_1 R_2}{R^2}$

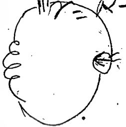
$R R_1 R_2 R^2$

$g = 2P - R$ $\quad \frac{\cancel{R_1} R_2}{\cancel{R_1}} + \frac{R_1 \cancel{R_2}}{\cancel{R^2}}$

$g = R - 2P$

$r = R - (2P + g)$

3 5 = 7



Marion

600

$\frac{150}{600} = \frac{40}{20}$ 2

Sara Sarah Marion

126
~~63~~

		2.1004
comp	40	8.3978
Comp	1.08	9.9666
		0.4648

2.92 to a Volt

2.5539
~~.4668~~
2.0891 122.6 Volts
2.0891
1.6464
7.7764
3.6010 6010
.5185
.9175 8.23 per H.P.

Lamp No. 5

Dec. 13, 1880.

40 cells

~~61.5 L~~
~~69~~
~~7~~
65
61
~~8~~126
~~63~~

16 c

177 L
181 R
358

25127
8350
33477
167.38

5752
4648
.1104

129 Volts

Lamps No. 6 reg.
Dec. 13, 1880.

16 c

185 L
195 R
188 L 17 c.

185
191
374

31406
4800
$\boxed{3}$5206
176.03

324

5105
4648

.0457 111 Volts
0457
6464
8477 3850
5855
5185
9330 8.57 per lamp

Lamps No. 7 reg.

160 L
164 R
324

3.24

25127
3300
28427
142.13 Ohms

5250
4648
0602
0602
6464
6265
5933
5188
9252

115

3930

8.42 per HP.

Lamps No. 8 reg

165 L
170 R
335

25127
4700
29827
149.13 Ohms

5185
4648
0537   113.2

Lamp No. 9

162 L
168 R
330

25127
3400
28527
142.6

Lamp No 10

$$\begin{array}{r} 159 \\ 164 \\ \hline 323 \end{array}$$

$$\begin{array}{r} 2512 \\ 2200 \\ \hline 2)27127 \\ \hline 135.6 \end{array}$$

Lamp No. 11

285 L
247 R

31406
3600

Lamp No 12

25 v. L

25127
3600

368 5658
3978
9665
9302 8.51

3464
9302
4162 26.1
4162
6464
5031
9819 959
5188
5366 34.4 per H.P.

1/4 length lamp

4 c

Dec 5
1880

110 L
112 R
222

16279
31.38

Went up after burning 2.42 hours at 24

4232
9307

4930
4930
6464
5302

1626
5188

3559

11450

22.7
8

181.6

1/3 length way

8 Candles

131 L
134 R

265

5900
295

4518
9302
5216

5216
6464
5376
2272
5185
2913
0792
3705

16.80 ~~[illegible]~~

19.5

234. candles per H.P.

1/3.4 length reg

12 [illegible]

140 L
143 R
283

5800
29.

4698
9302
5396
5396
6464
5427
2683
5185
2502
2041
4543

1850

284

1/4 legth reg

16 Candles

145 L
150 R
295

15730
28.65

4671
9302
4569   28.8
4569
6464
4034
9636
5155
5449   35.1

1/3 length   5

Dec 15 1880

5 1/3 candles

152 L
155 R
307

6279
1620
7899
39.49

at 24 C. at 8.55 P.M.
finished at 1.30 P.M. Dec 16 1880 . 16.5 hours

5302
9302
6000
6000
6464
4182
2653 1840
5185
2532 17.9

1/3 length [illegible]

10⅔ candles

167 h
172 R
339

6279
1350
7629
3.814

5399
9302
6297
6297
6464
4283

3341
5185

1844

$\frac{U^2 \times 4413}{R}$

15·3 per H.P.

1753 ft lbs.

1714)33000 (1.
1714

4.1655708
1.6464037
8.4317983

4.2437728
5.7562272
4.5185139

0.2747411 1818 H.P.

1/3 length way

16 candles
very ~~br~~ brilliant

179 L
184 R
3)363
121

40 cells

187 R
181 L
368

6279
1180
7459
3702

3.165708
64600

~~20~~ 40 cell = ~~150~~ 64 ~~150~~ 64
lamp 20 14

64
64

128

185 − 185

31406
1700

33106
16 C

166. Ohms

8.2 per H.P.

Lamp 15

~~went~~ I put it in
the Phone room and
an arc spring
and it went.

Lamp 16

167 – 167

25127 + 2500

16 C

$$\begin{array}{r} 25127 \\ \hline 27627 \\ 1381.1 \end{array}$$

$$\begin{array}{r} 167 \\ 167 \\ \hline 334 \\ 111.3 \end{array}$$

8.3 per ~~H.P.~~

Lamp 17

165 – 165

·25127 + 3500

16 C

$$\begin{array}{r} 25127 \\ \hline 28627 \\ 1431.3 \end{array}$$

$$\begin{array}{r} 165 \\ 165 \\ \hline 330 \end{array}$$

110

$$\begin{array}{r} 0414 \\ 0414 \\ 6464 \\ 8447 \\ \hline 5739 \\ 5185 \\ \hline \cancel{4846} \\ 9346 \end{array}$$

3750

~~3330~~

~~Spheres per H.P.~~

8.4

Lamp 18

165 — 165

25127
2000
27127

165
165
330
110

135.1

16

6414
0414
6464
8697

3970 5989
5165
9396

8.67

Lamp 19

158 — 158

2100
25127
27227
1360

158
158
316
105 Vol

16

8.9 ~~[illegible]~~ H.P.

Lamp 20

173 — 173

25127
5800

30927
15463 Ohms

16 C

Lamp 21

176 — 176

31406
157 ohms

16 C

22

165 — 165

25127
4100
(29227
146.1 Ohms

16 C

23

164 — 164

25127
1100
26927 134.6 Ohms

16 C

24

165 - 165

25127
2000

16

25

167 - 167

25127
1700

16

26

176 – 176

25127
4800

16

27

162 – 163

25127
1700

16

28

178 - 178
25127
4700

16

29

Bad voe.
went up.

30

17.8 — 178

| 31406
157. Ohms

16

8.2 per H.P.

178
178
| 356
119 Volts

31

168 — 168

25127
2000
| 28127
1406 Ohms

8.4 per H.P.

168
168
| 336
11.2 Volts

32

165 — 165

18840

5500

16

4312 : 64 :: x : 168

64)72576(113

256

83

168 — 168

25127

3500

16

128627

143

112 5

143 R

158 — 185
138
27
1
28

130 Ohms
160

158
.158
316
105. Volts

106 Volts

.0253
.0253
.6464
.8861
.5831 — 6970
1139
5831

30 .5831 3830
34
31 5797 3800
33
132 5764 3770
33
133 5731 3740

133 5731

32

134 5699

32

135 5667

32

136 5635

31

137 5604

31

138 5573

31

139 5542

31

140 5511

30

141 5481

30

142 5451

30

143 5421

30

144 5381

3740

3710

3690

3660

3645

3610

6970
146 1644
5326
30
6

6970
1614
145 5356 3430
30 3600
146 5326
29
147 5297
29
148 5267
29
149 5238
29
150
5209
29
151 5270

	6970
	1818
152	5152
	29
153	5123

34

150 - 150

18840
2700

1C C

35

150 - 150

18840
2700

16C

36

154 – 155

18840
3300

16 C

37

160 – 159

25127

16 C

150 – 150
18840
4500

16e

2)23340
116

177 – 177
25727.
16e

40

165 - 165

25127
2000

16 C

41

150 - 150

18840
2300

16 C

42

156 - 156

25127

16 C

43

150 - 150 ✓

18840
4600

16 C

172 - 172

25127
3800

16 C

149-157
18840
3000

16 C

46

192 - 192

$$\begin{array}{r} 25127 \\ 6500 \\ \hline 16 \end{array}$$

47

149 - 149

48

163—165

25127 + 2500

16 C

49

149—149

2500

16 C

150 - 153
25727
900

16 C

178 - 178

52

155 - 155

53

155 - 155

25127
2000

16

54

~~156 - 156~~

168-168

25127
4550

16

55

155 - 155

177 — 172,

170 — 170

158 — 158

152 - 152

60

192. — 193

61

158 — 158

62

165—165

25127
2700

16

.165

3)330
110.

2000 : 100 : 215000
75

~~2400~~

2400 :

63

157 — 157

18840 1:L
3200

16 422240
1:1

2000 : 100 : 1980

~~2000~~) 198000
99

~~2000~~ : 1000 : 1800

2) 190000
95

2) 180000
90

1

64

164—164

65

166—166

66 a

157 - 157

67 a

Went up.

68a

~~174 — 17~~

146–146

69a

174–174

70 a

170-170

71 a

153-153

165 – 165

158 – 158

74 a

200, 200

75 a

170–179

155-155

164-164

78 a

166 — 166

188 - 188

80 a

150-150

153.153

82 a

190—190

83 a

153-153

84 a

166 — 166

158 - 158

86 a

195 – 195

87. a

160 – 160

88 a

150 – 150

89 a

168 – 168

90 a

177-177

91 a

165 165

92 a

160 – 160

93 a

259

~~164 – 164~~

162 – 162

94a

1760 — 1770

95a

1775—1775

96 a

~~106~~

~~165 – 165~~

163 – 163

183 – 183

98 a

165-165

99 a

176-176

100 a

175 - 175

101 a

172 — 172

102 a

177-177

103 a

173-173

104 a

173-173

Clamp Split

105 a

173-173

106 a

165–165

107 a

175–175

108 a

106—106

109 a

159 -159

$C = \frac{E}{R}$

~~CR~~

$C = \frac{E}{R}$

$E = CR$

$R = \frac{E}{C}$

C

marion

2

2

M M

m man

110 a

175—175

111 a

174—174

112[a]

178-178

$$\begin{array}{r} 178 \\ 3\,\overline{)356} \\ 118. \end{array}$$

113[a]

180—180

114 a

166—166

~~188—188~~ 1

170—170 2

116

yes?

169 — 169

1615

1660 1880

1

1.45

1/4

1.45. W

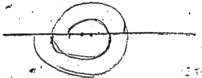
98 U a

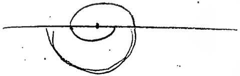
Ro..6 o

117 a

169 — 169,

118





80
67
13) 67 (5.1
65
2

5.1
5.1
2

5.1
5.1

25.51
5
26.01
2
52.02

2(4

133

Menlo Park Notebook #125 [N-80-11-16]

This notebook covers the period November-December 1880. The entries are by Edison, Albert B. Herrick, Charles Batchelor, and Francis Upton. The drawings by Edison relate to lamp experiments designed to prevent the "carrying of carbon by electricity." These experiments led to the discovery of the "Edison effect." The notes and drawings by Herrick, which comprise most of the book, concern experiments to chemically treat carbons, to improve vacuums, and to devise a better method of clamping carbons to the lead wires. The notes and drawings by Batchelor deal with improved vacuum pumps. The calculations, notes, and drawings by Upton pertain to conductors and to experiments in electricity and magnetism. The book contains 282 numbered pages.

Blank pages not filmed: 84-91, 160-161, 164-265, 268-281.

Missing page numbers: 127-128.

N-801116

1

Nov 16 1880

Bast Fiber:

First Experiment - 102

soak the fiber in Sulphuric acid as [illegible] parch- ment paper [illegible] wash clean with slightly ammonia- ted water

two lots of the above are soaking there this 2 hours in sulphuric 81.542 sp. gr.

---

101 Edisons Experiment in dipping Bast fiber in sulphuric acid unknown sp. gr. time

These experiments No 2 & 3 were no good fibe lost all its stability and decomposed loosing the fibre completely

Experiment in test tube No 2 consists of five pieces of fiber 2 large 2 small 1 medium in Sulphuric acid of 1.542 started at ~~[illegible]~~ 5 on dial [illegible] soak tile & again

took one piece from testtube at 35 minutes washed in ammoniated water

No 2 Exp fiber dryes [illegible] and no good [illegible] notice that the coloring matter is more evenly distributed in No 2 than No 3 Sulphuric the same

Both these testubes filled
with ~~alcohol~~ alcohol
and bast-fiber dipped.
Then no 4 allowed to stand
~~(20 minute~~ no 5 allowed ~~three~~
~~220 before started~~

8 hours no precipitate
change in the color
of alcohol still remaining
in 4 hours no change
no change by night

In test tube No. 3 same
as no 2 but to soak 2 hours

Sulphuric acid 1.8425 sp. gr
In testing sp. gr of this acid
and the [illegible] only
went as far as 1.800 to 2.0
my results are not perfectly
reliable as regards sp. gr.

6

1 part Hydrochloric acid diluted in 5 parts of water fiber immersed and remain from 5 min Bdst-Co.

No 4 & 5 no change over night in cond of Hydrochloric

No 7

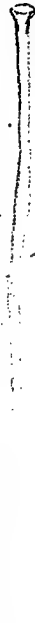
Hydroflouric acid diluted 1 + 5 times it requires vacuum

~~Not Tried~~ On The Dk

Tried with several fibers over 5 times its bulk in water time 1/2 hour action not very violent but ~~m~~ modified by the silicon in the fiber, Bdst.

Shows some

The fibers were lighter than by the action of any other acids



Hydrochlorine and 1 to 5 of #40

Bundle the fibers
rather tightly and insert
in tube (swell by soak
ing) be careful in
packing tubes. length-
~~The longer tube better~~
8 feet - 1/2 in pipe
1 cm in weights.

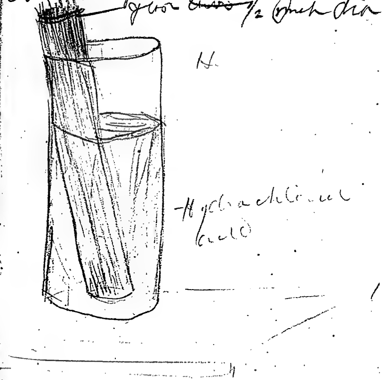
2 $\quad 2\overline{)96}$ $\quad 16\overline{)96}(1$
$\quad\quad 42$ $\quad\quad 16$
$\quad\quad 2$ $\quad\quad 50$

1 3/4 lbs or $\overline{\text{l.l.}}$ in

Tube residue
for testing
- fibers advantages of
Hydrochlorine
is ~~that~~ it attacks more
metals and leave
less of a residue

Heated the fibre to make them smell more in the tube before putting them under pressure

~~Hor~~ Capilarity glass ~~tubes~~ 1/2 inch dia



Ex no 6 Dipped fibres in Hydriodoric acid ~~and~~ working by capilarity sucking the acid through them Hydrocloric diluted ~~$\frac{1}{16}$~~ 1/16 -8

Haines

Put in tube No 5 - some leaves for clarophyle on ~~two~~ Bast-fibers Nov. 17

Also soaking some fibers in alum water and as soon as soaked thoroughly will dip in sulphuric acid

---

Regularly parchmentized ~~[illegible]~~ upon some fiber gave fair results but the action only was on the surface of the fiber any next experiment will tend to act on all parts of the fiber by capillarity and presence of ~~the fluid~~

Got a ~~thin~~ pithy piece
of Bast and ~~could~~ ~~see~~ can
see ~~the pith~~ and pith hole
[illegible]mply will see if the
acid (Sul.) will act on
that ~~differently~~ than
~~the body of the~~ fiber
Result was that small white
crystals formed on the surface
of the carbon esp. nearly where
cut before heating with Sulphuric
and ammoniated water

crystallized in

another experiment
conducted as the
above

Alum one

Ammonia ~~Hydrate~~ = Sulphurine

Dose

2
29 2

Black to the eye ~~if~~ electrically illuminated
is increased ~~after~~ steeper
fact to the eye and microscope
with ~~cannot see~~ have not been
~~seen ... ...~~

Notice and then some white
crystals as in sulphurine grains
not as jasper a [illegible]
by ~~ex~~ comparative ex-
amination [illegible]

[redacted]

[redacted]

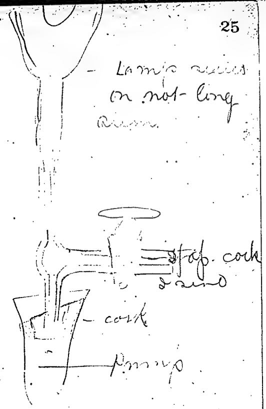
As to Nitric acid
Dilute X% water
Give muscle in acid
Leave Nitric acid over
night—

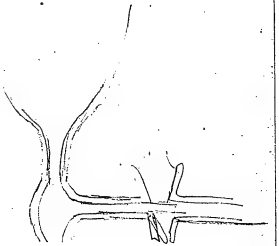
No 9 Ether some
Bass soaked in ~~te~~ ether
corked in ~~testtube~~ No 9.

Hydrochloric acid
and small bits of fiber
with ammonia

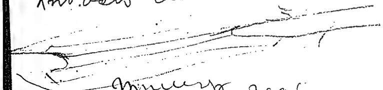
~~action violent~~

Had to leave fiber up
for depositing experi-
ments but let the
fiber stand in the
test tubes


Lamp
on not-long
stop cock
cork



Started pump and lamp
at 12.30 commenced
working formed Hydrogen
under pressure 1/3 min
in manometer mm.
hot pump clean
Rubbers clean.



Mercury real
manometer pressure
steady at 2 mm pump
working nicely lamp OK.
constant manometer
had high vacuum
turned on Hydrogen
and oxydized slowly
and most impurities

and suddenly broke
tried with rubber
now try with glass
cock

Glass cock works well
but ~~the~~ first Lm. No 1
was low resistance
and did not change
by running Edison test

No 2 Li. No 1 Lamp Glass
cock ordinary vacuum
with a few grains
of Napthaline in plum
leading to bulb glass
heated while running

at just on account
of vacuum increasing
(supposition) I fused the
naphthaline on ~~the tube~~
after 15 min. burning
and increased light
perceptibly burning
about 22 candles now
judge after fusing

Naphthaline left - other
residue on ~~tube~~
Very bright and burned
~~4~~ 36 seconds at about 500
candle power it broke
greatly and took it out and
examined fiber was dis-
integrated and ~~broke~~ parallel
to the fiber

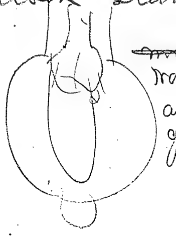
Mistake to freese
the Naphaline

Trial twice second
and first are smaller
together and gave a
good result of 500 candle
power Judged by Edison

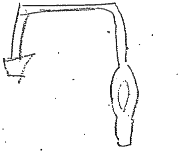
20
23
21
36

$4 \,\overline{)\,100}$
25

Next bend over and put ~~[illegible]~~ Naphthaline inside of globe and have carbon standing



naph. scattered around inside globe



45^{0} $40''$ $30'''$

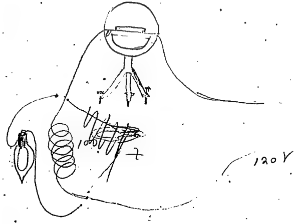
20) 60 (
3

45

30^{0} $2''.5$

29^{0}

29^{0}



100 19.

Second Test –

Stand. Ohms	Deg. Temp	
100	19	.34,4328 = .105
90	20¼	.34~~4~~481
00	23	.424475 –

100) 344328 (.35

34.437800

1

.0003

34.4328

.103

Throngs Deg

Restilic

Khan

100	27
90	29
80	35
100	28
90	30
90	$30\frac{1}{2}$
80	33
100	26
95	28
80	32
90	33
100	29
95	30
90	34
	$33\frac{1}{2}$

27
28
26
29

$4 \overline{)110}$
$27\frac{1}{2}$

$27\frac{1}{2} = 100$

29
30
2

35
33
32

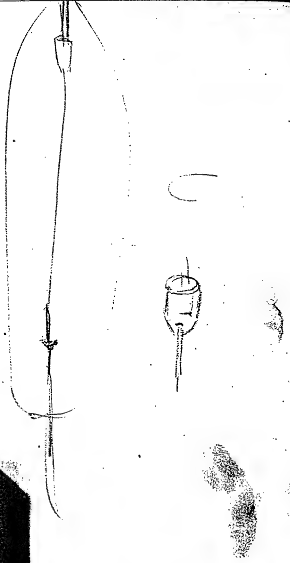
$3 \overline{)100}$
$33\frac{1}{2} = 80$

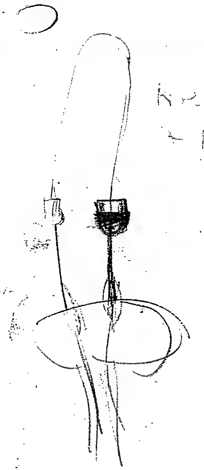
~~Commenced~~

Commenced Pump
at 12 m.n.

Lamp to be lit
without Naphthaline
at 12,55

5 Mm	11	Standing at 13 [illegible]
"	14	
	15	Boiling
without	9	
on Burner	7	Standing at 20
"	6	
No [illegible]	21	Lit Vapor in [illegible]
		on the Hole
		25 at high Temp
		[illegible] at [illegible] Lamp

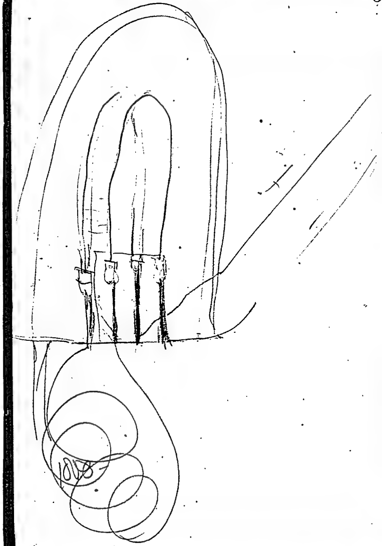




Kragen
+ Hemde

First Experiment —

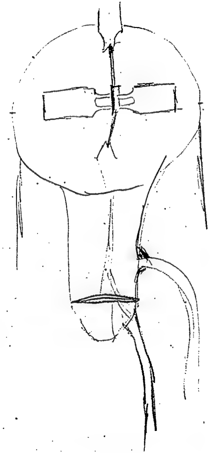
Dr. [illegible] had a vacuum Hydrogen [illegible] —

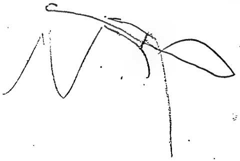


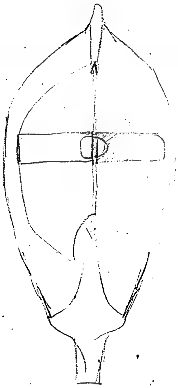
had a double pump one
side made with large con-
tration and other a small
contration with small
fall tube The large tube
was to large for the con-
ration and would not-
work as after three
trials sealed it off
and let the small
contration and small
fall tube worked
moderately well but slow
and had no arrangement
for testing vacuum
but think it was not
high lamps was a depositing
~~lamp~~ carbon

Lamp No. 1

The next was a regular
pump ~~[illegible]~~ Hg. heated
to about 110° [illegible] and worked
very well given Insulat-
ing ~~[illegible]~~
2 heated bunning in a
glass bottle (but bottom fused
out and lost my vacuum
had com. [illegible] bottle
and heated [illegible]
by Bunsen's burner
1st lamp ~~took~~ reg. bamboo carbon
for first experiment and
exhausted to a high degree
2 in spark from large coil
would not pass in heating.
The ~~[illegible]~~ lamps & they
61 Page Con.







were just heated with
very low current at first which did not bring to incandescence
which perceptibly showed
by the spark and drops
of ~~mercury~~ Hg carried
down more and between
them gradually heated to
lamp and ~~took~~ sealed
with higher vacuum in
about 4 hours tested for
economy (Page 62) per horse
power — external heat
of globe burning at
16 & ~~18~~ candles was 75° Far
Second lamp brought up
as the first — but after

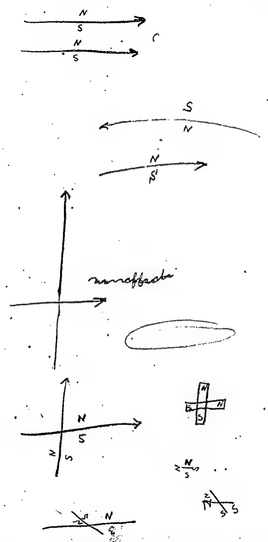
pumping will get high
vacuum ~~on~~ no blue
on clamps no deposit
on globe and ~~putting~~
light of 18/ candle power
~~[illegible]~~ Edison put magnet
to pos/ pole and ~~attracted~~
~~From the clamps~~ on blue
matter which gradually
left with high vacuum
~~but~~ when last seen seemed
to have a ~~[illegible]~~ tendency
for the centre of the clamp
~~that is~~ where formed a
circle ~~[illegible]~~ below ~~[illegible]~~
of clamps near the pump

about 6 hours
Lamp [illegible]
Keeping mercury at 107
to 110° Far. & this Lamp to
be brought up high as
nos 14 & 2 but after using
all of evacuation by small
horse shoe magnet near
large electro-magnet with
two batterys, applied to
pos. pole of Lamp and
pump[illegible] [illegible]

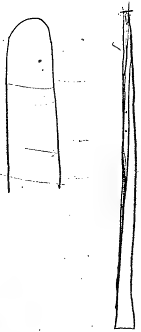
 Nov. 26
Coal - 1½ miles
on spark

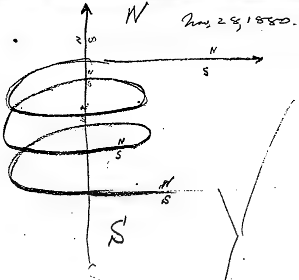
Commenced Nov 27 Pumping
on Hayd's camp at -
11.5 am. Old pump
cleaned

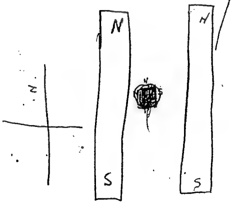
Got damp [illegible] night -
could not [illegible]
5 in spark 1/16 [illegible]
mals in spark
gage commenced
1 1 stopped 4.30
5:30 time to get -
[illegible]

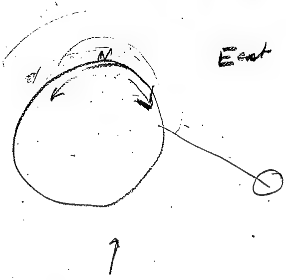


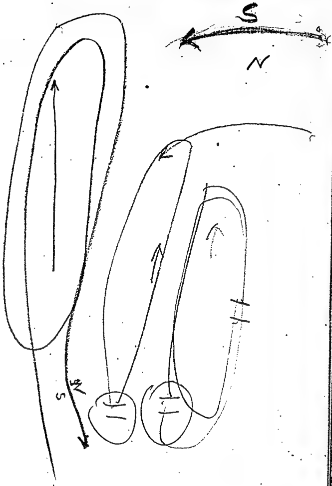
N
S
N
S
S
N
N
S
N
S
N
S
N
S

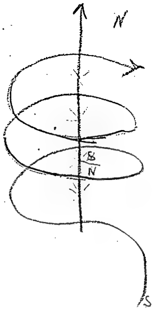


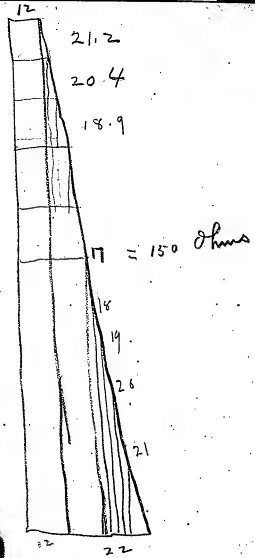

N
N
S
S


N
S
N
S


N
East


S
N
S


N
S
N
S



12 : 17 :: 150 : 212 Ohms

$$\begin{array}{r} 150 \\ \times 17 \\ \hline 1050 \\ 150 \\ \hline 2550 \end{array}$$

12) 2550 (212
24
15
12
3

212 Ohms

21.2 to division

21.2 Ohms

$$\begin{array}{r} 21.2 \\ \times 2 \\ \hline 42.4 \\ 212 \\ \hline 254.4 \\ \times 2 \\ \hline 508.8 \end{array}$$ Ohms

$$\frac{1}{R} = \frac{1}{R'} + \frac{1}{R''} = \frac{R'+R''}{R'R''}$$

$$R = \frac{R'R''}{R'+R''}$$

$R' = 21.2$

$R'' = 509$

$R' + R'' = 530.2$ Ohms

R'

```
   21.2
   509
  1996
  1060
530 )10790.6 (20.4 Ohms
     1060
     1906
```

~~maximum~~

$15 : 14 :: 20.4$

```
  20.4
    14
   816
  204
  2856
```

```
15 )2856 (19.0
    15
    135
    135
```

$R' = 20.4$

$R'' = 254.4$

~~458.4~~

```
  254.4
   20.4
  10176
 5088
 5189.76
```

```
2748 )5189 (18.9
      2748
      24410
      14732
```



```
6 )1.0 (.017
    6
   40
```

```
5280
~~2640~~
1760 feet
```

38.7 lbs of Cu per ft

```
   38.7
     36
   2322
  1161
  1393.2
     600
  835,920.0
```

```
  36
   7
 252
  14
3600
```

~~2400~~

2800 tons of Cu ~~to run a 14 Ohm lamp~~ for 600 lights at a distance of two miles.

18.9

16 : 15 :: 18.9
15
945
189
16) 283.5 (17.7
16
123
112
115

17 : 16 :: 17.7 : 16.66
16
1062
177
17) 283 2 (16.66
17
113
102
112
102
10

18 : 17 :: 16.66 :
17
11662
1666
18) 2832 2 (~~153~~
18
103
~~98~~
~~50~~
90
130
126
4

15.67
15.73

19 : 18 :: 15.73
18
4

1.1968
1.2553
8.7212
1.1733 14.9
1.2788
20 8.6990
1.1511 1.4.2

1.1511
1.3010
21 8.6777
1.1298
~~1.3223~~
22 1.3223
8.6575
1.1696

12.9
13.4
14.2
14.9
15.73
16.66
17.7
19.
20.4
21.2
166.09

Ohms.

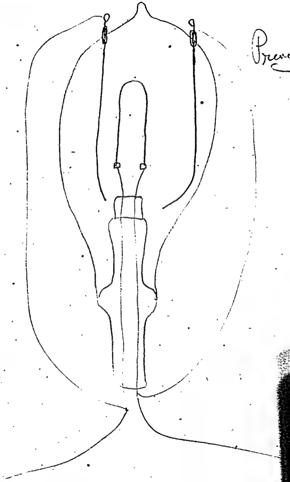
Decreasing carbon
0".012 to 0".022

Lamp on 6-15 A.M.

First current 8-15

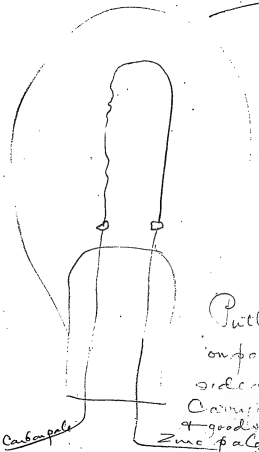
Dull red 8-40

Nov 28 1880 9AM



Prevent Carrying

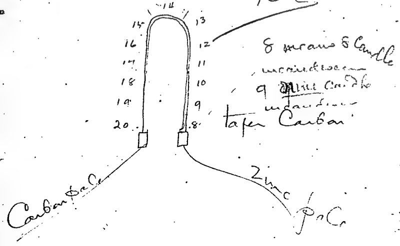
Nov 29 1880 TAE



Putting bad spots on positive pole side around E Carrying Electricity & good side of Carbon Zinc pole will burst first

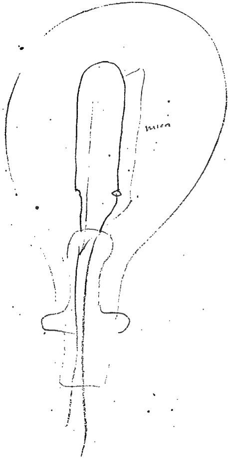
Nov 29 1880

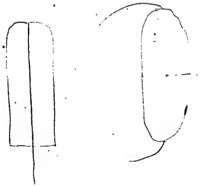
TAE



This method of Comparison of [illegible]
for the Carrying of Carbon
by Electricity as the Carrying
side has lower incandescence
and was the way we proposed
last summer

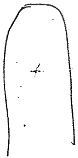
Nov 29 1880 TAE





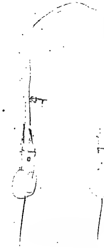
Large ~~Fattey~~ lamp Dec 6.

tried 4 times to produce
high vacuum with large
pump and failed, has
carbon changed and
old style pump.
work very satisfac-
torily Dec 6
small carbon ack.
at fig. 4 indications
of high vacuum and
had smokings on
globe. another small
carbon busted by pulling
on full current—try
in line air like in lamp

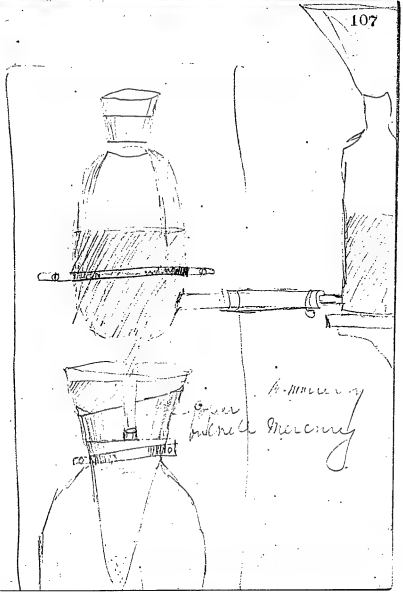


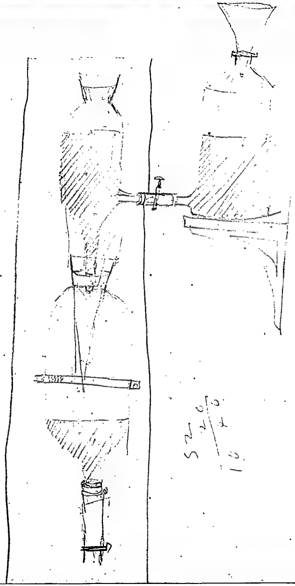
for bug. had a carbon
Bamboo 8/1000 Thick taper-
ing from 22/1000 to 12/1000
put near a spot on +
pole the force again blue
Also had common carbon
on but mercury jumped
on the Batchelors lamp

Dec 8 1880



~~at~~
When burning
is repelled
1/4 in and no
Change g read
really attracted
to carbon

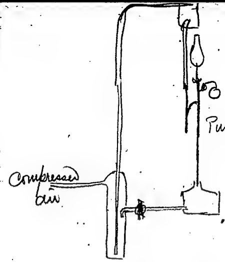

Green
Mercury



So W[illegible]ed
~~written~~ allowed on
these books like
the crossed

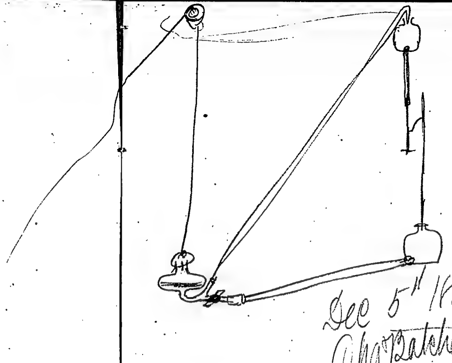
3rd.
Cont with [illegible] acid
RP Run through paper funnel
in Reg. [illegible]
2nd
Run thing [illegible]
and [illegible] — save
1.2.3. and [illegible] and [illegible]
15° of [illegible] running

Dec 5th 1880



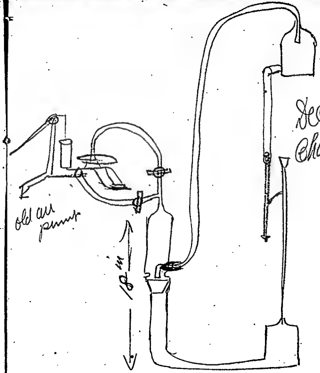
Chas Batchelor

Mercury lifting



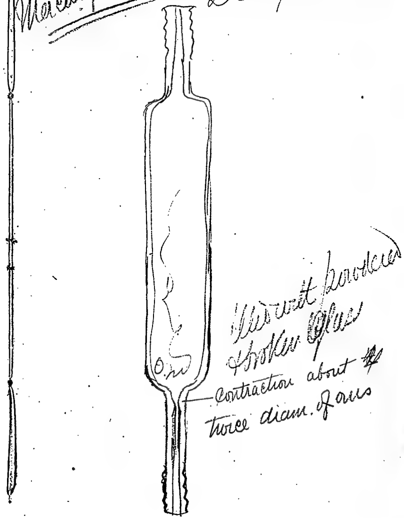
Dec 5th 1880
Chas Batchelor

Mercury raising



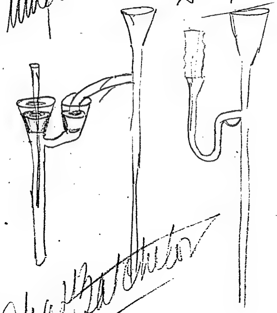
Dec 5th 1880
Chas Batchelor

Mercury Cleaning Dec 7th 1880



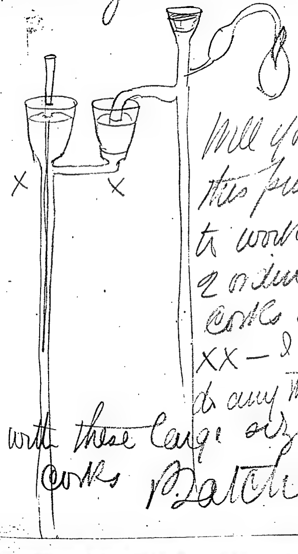
Pumps

Dec 7th 1880



Chas Batchelor

Mr Holzer Dec 6th 1880



Will you alter
this pump
to work with
2 ordinary
corks at
XX — I cannot
do any thing
with these large size
corks Batchelor

12 : 128 :: 10 : x

12) 1280
107

16 : 128 :: 10 : x

128

10 : 128 : 16 : x 2048
16
768 4
128
2048

10 : 306 :: 16 : x
16
1836
306
10) 4896

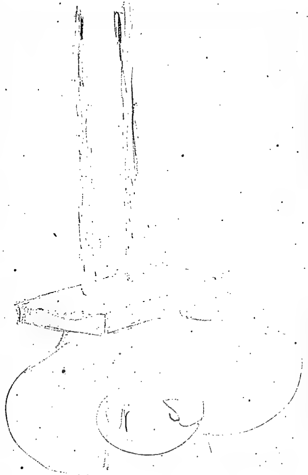
Chals:

Charles

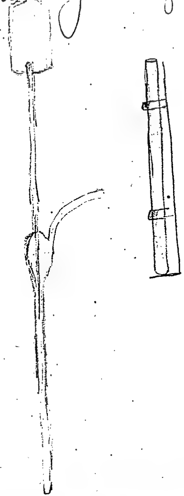
Bo

Tho A Edison

Tho A Edison



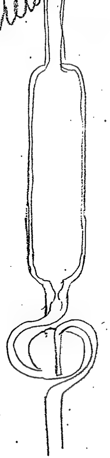
An engine to be worked by expansion and contraction of mercury — Theory

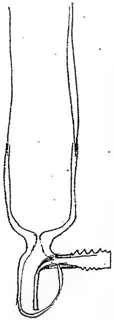


Mercury Cleaners

Dec 7 1880

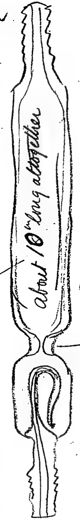
Chas Batchelor





Mercury cleaner

Dec 7 1880
Chas Batchelor

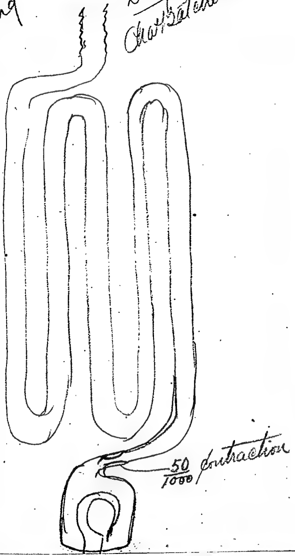


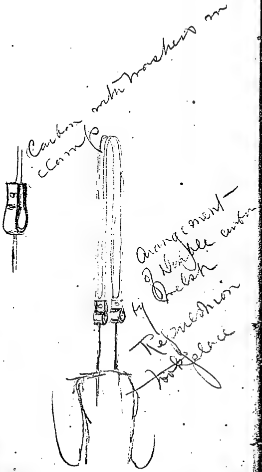
Frank make me one just like last night's only a chamber at bottom and a siphon so that any of the pieces of glass will not go through the pump
B

on next page also

Mercury Cleaning

Dec 7 1880
Chas Batchelor



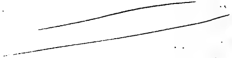


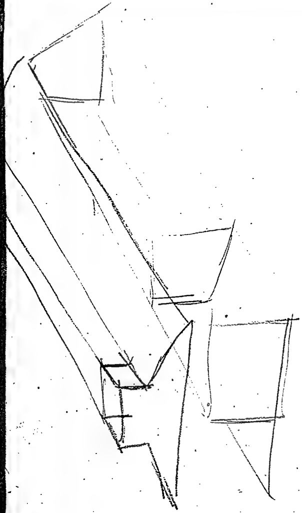
Dec 11 1880

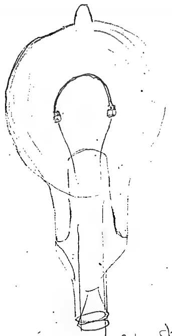
Tried carbon with washers of large parts of old carbons

Sealed off High vacuum

Tried clod







tried a lamp like the above
today Dec 13 1880 very good
results 1/4 size 5 times incandes
cence very black but sealed off
all right

$$\begin{array}{r} 630 \\ 435 \\ \hline 155 \end{array}$$

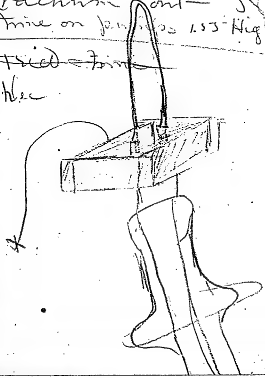
1.55

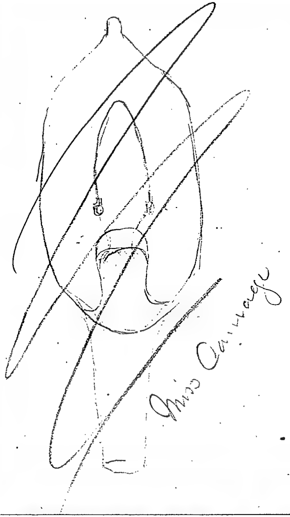
Also sealed off a lamp a ~~little longer~~ which gave about ~~the same~~ results — Just working upstairs with four pumps instead one on getting vacuum out — S. e. G.

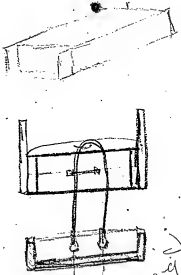
Time on pumps 1.55 High vacuum

~~Tried — Firm~~

Wec




Miss Carriage



for placing the canvas
on Climb Spar

1 .14
2 ~~17~~ 1/2
4 3 1/2
8 1 3/4
16 :

29-

C
16 — 3,400 ft - lbs
150 — 3550 "
mac.

155 C . 33000
275 C 33000

16 / 3400 (212
32
20
16
40
32

212
50
10.600

3.4

3400 ft - lbs.

4604
2
8368
3
25104
2
56208
2

33 ~~00~~) ~~11224~~
37

33 / 112 (43
99
130

Lamp D.
W
: 1.35 — = 5131 ft-lbs.

Lamp A.
4.07

Lamp D
1.35 Weber = 5131 foot-lbs.
Lamp A
4.07 Weber = 5850 " "

$$\begin{array}{r} 4.07 \\ 1.35 \\ \hline 2.72 \end{array} \text{ Weber} \qquad \begin{array}{r} 5850 \\ 5131 \\ \hline 719 \end{array} \text{ ft-lbs.}$$

Lamp A.
4.07 Weber = 5850 ft-lbs
Lamp D.
1.35 " = 5131 " "
2.72 " 719 " "

1.35 : 5131 : 4.07 : x

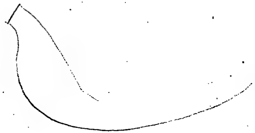
$$\begin{array}{r} 5131 \\ \times\ 4.07 \\ \hline 35917 \\ 20524 \\ \hline 20883.17 \end{array}$$

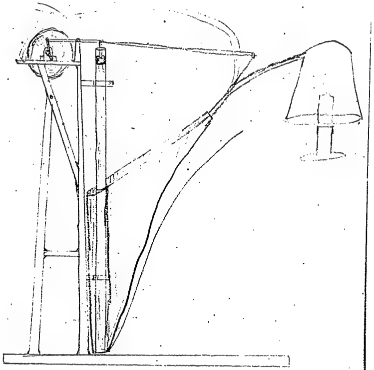
$$1.35\,)\,20883.17\,(\,15469$$

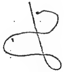
$$\begin{array}{r} 20883.17 \\ 135 \\ \hline 738 \\ 675 \\ \hline 633 \\ 540 \\ \hline 931 \\ 810 \\ \hline 1217 \\ 1215 \\ \hline 2 \end{array}$$

15469

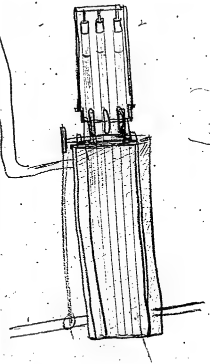
2 2
1
4'''
3''







400



25
3
5

2400
2
4800

14.951

Tho A Edison

800

6000
2

Tho A Edison

4

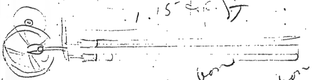
48

Street

Street

Street

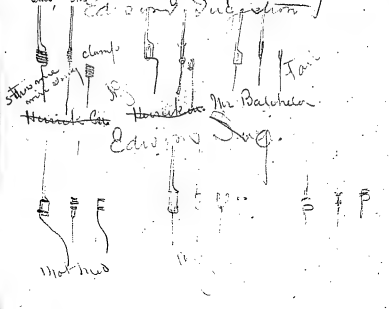
1.15

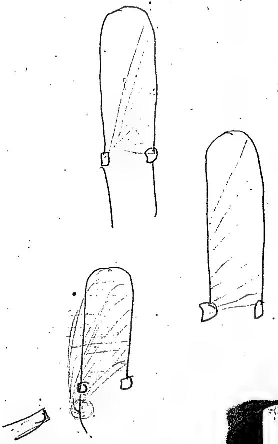


Good Carbon

Good Carbon

Dec 18. Different Ways for clamping Carbons for plating (Edison's Suggestion)





Menlo Park Notebook #126 [N-80-07-21]

This notebook dates from July 1880. Most of the entries are by Edison and consist of drawings that appear to be related to the ore separator. There are also a few pages of notes, possibly by Martin Force, relating to connections in the photometer room. The label on the front cover is marked "Ore Milling" and "Martin Force." The book contains 282 numbered pages.

Blank pages not filmed: 8-279.

.25
.05
.0125

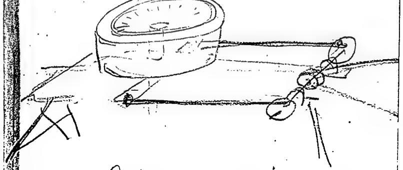
.25
.5

5 : 25 :: 4 : 150

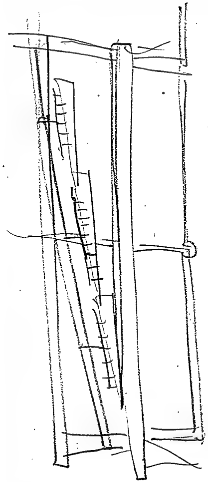
25) 5.00 (20
50

35 [illegible]

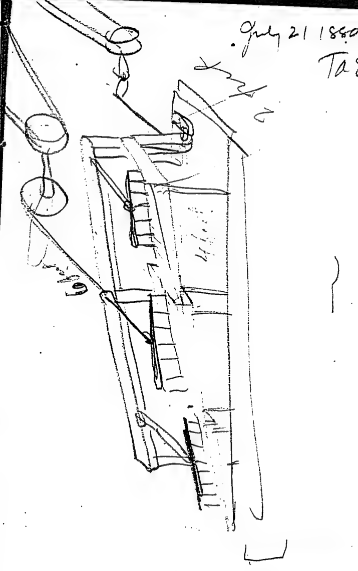
July 21 1880
TAE



Shaking tube with air or water



July 21 1880
TAE



Sept 13th 1880

TAE

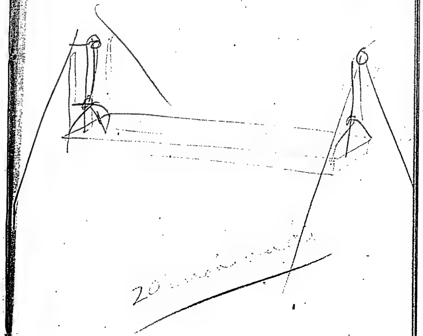


Diagram of connections from instruments to photometer room.

No 1 & 2 To resis. in phot. room.
" 3 " 4 To Lamp
" 5 " 6 To Line
" 7 " 8 To rest in photometer room

33 1/3 percent

3 first

2 and

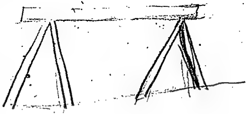
6 for

157

10

5

15



9 for One Thousand

T. A. Edison

33 1/3 Per Cent

Menlo Park Notebook #127 [N-80-00-05]

This is the first of three notebooks that contain the results of a search, conducted by Otto Moses during the summer of 1880, for literature relating to the electric light. (See also Menlo Park Notebooks #128 and #176.) The citations are listed in alphabetical order by author. There are three sets of listings, beginning on pages 1, 136, and 220. The book contains 284 numbered pages.

Blank pages not filmed: 228-284.

IT is a time-honored maxim that "actions speak louder than words," and "by its fruits shall the tree be known." Let us see, then, what results this rule will bring forth if applied to those with whom we

90

From the Laboratory

OF

T. A. EDISON.

MENLO PARK, N.J.

No. 127

N-(~~79-00-02~~)

80-00-05

Albert, Dominique, 2

Alderson, Dr. James. 3.

Allen, Wm. & Wm Haseldine Pepys.

Alluaud (aîné) F. 7.

Aubergier, Hector, 2.

Aubert.

Process of carbonizing turf without close vessels, the peat furnishing its own caloric without producing ashes. [1839]
Manch. Soc. Mem. VI., 1842 p. 399-408

On an artificial formation of plumbago [1825
Camb. Phil. Soc. Trans. II., 1827. p. 441-443

On the quantity of carbon in carbonic acid and on the nature of the Diamond.
Phil. Trans. 1807. p. 267-292.

Analysis of a carbonaceous substance found in a porcelain furnace. (see page 57.)
Annal. de Chemie IV., 1817. p. 67-70.

On the combination of Hydrogen with the metalloids.
Journ. de Pharm. XXII., 1836 p. 257-265

On the spontaneous ignition of pulverized charcoals.
Annal. de Chem. XLV., 1830. p. 73-84

Baillet, A. 7.

Barthe, E. 2.

Becquerel. H.: (see Wöhler

Beetz, W. 26.

on increase conductivity Carbon by heat. Brass filings & plat black in tube ✓.

Berr, Franz

Berthelot, Marcellin 3.

——— 8

Note on the carbonization of wood and turf.

Journ. des Mines. XI., 1801, p. 253–256.

On the products extracted from coal tar.

Presse Scientifique II., 1860, p. 329–330.

On the decomposition of sulphide of Carbon by Electricity.

Pogg. An. XVII., 1829., 183.–184. (See Wöhler do. p. 482, 483

On electrical conduction through carbon and metallic oxides.

Poggend. Annal. CXI., 1860, p. 619–621.

On the products of combustion from wood and fossil combustibles.

Brünn. Verhandl. I., 1862., p. 31–33.

Action of a red heat on alcohol and acetic acid.

Annal. de Chem. XXXIII., 1851, p. 295–302.

On the precautions to be taken on heating bodies in closed vessels

Journ. de Pharm. XXIII., 1853, p. 351–361.

Berthelot, Marcellin, 35.

——, 62.

——, 81.

Berthier, P. 98

Berthollet, A. B. 2

On the analysis of carburetted gases.
Annal. de Chemie, LI., 1857, p. 59-81

On the protosulphide of carbon.
L'Institut, XXVII., 1859, p. 364-368.

Synthesis of acetylene by the direct com-bination of carbon and hydrogen.
Paris. Comptes Rendus. LIV. 1862. p. 640-644.
Chem. News. V. 1862, LXXXV, 1862, 184-185.

Examination of some combustibles.
Annal. de Chemie, LIX., 1835, p. 225-263.

Analysis of bitumen from Seyssel.
Bibl. Univers. XVII., 1838, p. 183-188.

Researches on the reciprocal action of sulphur and carbon.
Arcueil, Mem. Phys. I., 1807, p 304-332.

Berthollet, A. B. 3.

———————, 30.

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———————, 45.

Experiments on the combinations of sulphur and carbon.
Journ. de Phys. LXIV., 1807 p. 273-278.

Note on the memoire of Messrs. Clement + Désormes: "Experiments on Carbon" do. 121-152.
Annal. de Chemie, XLII., 1802. p. 282-288.

Observations on carbon and carburetted hydrogen gases.
Paris. Mem. de L'Institut IV., 1803. p. 269-318, 319-324, 325-333.

On the reciprocal action of carbon and sulphur.
Annal. de Chemie, LXI., 1807, p. 127-144.

New observations on inflammable gases designated by the names carburetted hydrogen and oxycarburet of hydrogen.
Arcueil, Mem. Phys. II., 1809 p. 68-93.

Berzelius, J. J. 47

——— and Alexander Marcet.

Bidart, A.

Bineau, Armand. 6.

Bineau, J. M.

Binney, Ed. Wm. 17.

On detonating oil; sulphide of carbon and a new curious compound.
Gilbert Annal. XLIII., 1813, p. 441-444.

Experiments on the alcohol of sulphur or sulphuret of carbon.
Phil. Trans. 1813, p. 171-199.
An. de Chem. LXXXIX., 1814, p. 67-87.

On the carbonization of wood resulting from a prolonged sojourn in the tertiary.
Paris, Soc. Geol. Bull. VI., 1834-35, p. 11-13.

Observations on chlorides of carbon.
Lyon. Soc. Agri. Annal II., 1839, 515-517.

Description of a process (at Rothau, of carbonizing turf.
Annal. des Mines, V., 1829 .. 211-222

On the origin of coal. [1846]
Manchester Phil Soc. Proceedings. Mem. VIII., 1848, .. 148-194.

Bischof, Gustav. 77.

———, 92.

Blavier, — 6

———, 8.

Bouesnel, P. M. 8.

Boussingault, J. B. 47.

On the origin of carbon in the vegetable and mineral kingdom.
Niederrhein. Gesell. Organ. II., 1842. 192-214

On the carbon of the atmosphere, and on and in the earth, and on some hitherto unconsidered processes of oxydation which are now going on on a great scale.
München Gelehrte Anzeiger XXV, 1847. 126-143

Additions to the process of carbonizing turf.
Jour. des Mines XXX. 1811. 373-378

Report on the carbonization of turf &c.
Annal. des Mines IV., 1819. 177-205.

Notice of a carbonaceous matter produced sometimes in blast furnaces.
Journ. des Mines. XXXI., 1812 p. 151-154.

On the composition of bitumens.
Paris. Comptes Rendus. III., 1836. p. 375-378.
Annal. de Chemie. LXIV., 1837. p. 141-151.

Braconnot, Henri. 50.

——, 51.

Brande. Wm Th. 20.

—— 21

—— 36

Brandes, Rudolph. 39.

3

Branthome —

Analysis of soot.
Annal. de Chemie XXXI., 1826 p. 37–53.

Analysis of lamp black. [1825]
Silliman's Journal. XI., 1826 p 386–388.

On the composition and analysis of gases from coal and oil.
Phil. Trans. 1820, p. 11–28.

On a substance produced during the distillation of coal tar. [1819]
Quart. Journ. Science VIII., 1820, 287–290

On peat and its products.
Roy. Inst. proceedings I., 1851–54, p 4–6

On the presence of bitumen in minerals.
Trommsd. N. Jour. d. Pharm. X, 1825, 126–138.

Chemical investigation of a turf from Pyrmont
Schweig. Journ. XLVI. (= Jahrb. XVI.) 1826. 475–481.

Analyses of coals from Sundsweyer, Saarbrück, Rodern, Lalaye, Liepean, Bouxweiler.
Journ. des Mines XXVIII., 1810. p. 363–378.

Brayley, E. W. 2.

Breithaupt, August, 39

———————— , 131

Brett, R. H. 4

————

Brewster, Sir David, 46.

On the rationale of the Filamentous and Mamillary varieties of carbon, and on the probable existence of but two distinct states of matter aggregation in ponderable matter.
Thompson's Ann. Phil. XII, 1826. 192-201.

On the artificial production of the diamond.
Erdman. Jour. Tech. Chem. IV., 1829 ... 43-48.

On a curious condition of a mineral coal.
Berg & Hutt. Zeitung. XVIII., 1859 .. 4-5.

* Experiments on the alleged conversion of Carbon into Silicon.
Phil. Mag. XIX., 1841. p. 295-305.

Additional remarks on the alleged conversion of Carbon into Silicon.
do. XX., 1842. p. 24-32.

Notice respecting a singular structure in the Diamond.
Edinb. Phil. Journ. III., 1820. p. 98-100.

Brewster, Sir David, 151.

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Brockedon, W.

Brodie, Sir Benj. C. Jr. 10.

Observations relative to the structure and origin of the diamond. [1833]
Geol. Soc. Trans. III., 1835, .. 455-460
Phil. Mag. VII., 1835, .. 245-250.

On a remarkable property of the diamond
Phil. Trans. 1841, p. 41-42.
Phil. Mag. III., 1852 .. 284-286.

On the pressure cavities in Topaz, Beryl, & Diamond.
Edin. Roy. Soc. Trans. XXIII., 1861 .. 39-44
Phil. Mag. XXV., 1863 .. 174-180.

On a method of forming the dust of Graphite into a solid mass.
Geol. Soc. Journ. II., 1846, .. 31-32.

Note on a process for the purification and disaggregation of Graphite.
Annal. de Chem. XLV., 1855 .. 351-352.

Brodie, Sir. B. C. Jr. 13.

Bromeis, C. 8.

———, 11.

Buchner, L. A. & L. Oberlin.

Buchner, Max. 3.

Bucholz. Ch. F. 89.

a On the atomic weight of Graphite.
Phil. Trans. 1859.. 249-259.
Annal. de Chemie LIX, 1859.. ~~466-477~~ 466-472.

On the compounds of Carbon and Iron.
Brit. Ass. Rep. 1842. (pt. 2).. 34-35.

On the content of iron in carbon, and its determination.
Liebig. Annal. XLIII., 1842... 241-251.

An Essay on the history of Turf, accompanied by a new analysis of its ash.
Journ. de Pharm. XX., 1834... 251-254.

On the carbon and silicium content of Iron.
Erdm. Journ. Pr. Chem. LXXII., 1857. 364-369.

Analysis of a peculiar bitumen, found in Saxony.
Annal. de Chemie, LXXXIII., 1812.. 323-328.

Buff, Heinrich L. 5

Bunker, J. M.

Bunsen, R. W.

Bussenius and Eisenstück.

Bussy, A.

B. On the constitution of the hydrocarbons, and their chemical nature.

Liebig Annal. C, 1856, 219-242.

Annal. de Chem. L., 180-181. Note. Reference is made to the complete article (of which this is an extract) as being found in Annal. der Chemie und Pharm. C. p. 219. (see above)

Vegetable origin of Anthracite.

Silliman, Journ. XXIV., 1833, 172-173.

On the gaseous products of blast furnaces, and their employment as fuel.

Ann. des Mines XVI., 1839, 201-249.

On some derivatives of Petroleum.

Liebig's Ann. CXIII., 1860. 151-169.

On Carbon considered as a decolorizing agent.

Quart. Journ. Sci. XIII., 1822. 257-277.

Cadet de Gassicourt, C. L.

Caignard de la Tour, Charles. 37

——, 38.

——, 40.

Cahours, Auguste. 3.

On clarification by means of charcoal.
Bull. de Pharm. III., 1811. 264–268.

ꝑ Essay on the crystallization of carbon.
Comptes Rendus. XXV, 1847 – 81–82.

Roasting of ligneous and other material, in glass tubes closed at both ends.
Paris. Soc. Philomath. Proc. Verbal.
1850.. 54–57.

ꝑ. – Study of the effect that heat can produce on woods, according to their species, age and hygrometric state when these bodies are contained in tubes of glass closed at both ends.
Comptes Rendus. XXXII., 1851.. 295–296.

On a new carburetted hydrogen obtained from oil of irish potatoes. $C_{10}H_{12}O_{2}$(?)
Comptes Rendus VI., 1838,– 656–657.

Cahours, Auguste. 22

——— 27

———, 44.

— , and J. Pelouze, 2

Callias, -

Cancrin. Graf von.

Cannizzaro, Stanislao. 4

———, 11.

4 On the action of perchloride of phos-phorus on organic substances.
Comptes Rendus. XXII., 1846.. 846-850.
also vide. Annal. de Chemie XX., 1847-369-378.
" " " " XXIII., 1848.. 327-357.

Resear-

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Researches on American petroleums.
Comptes Rendus, LVI., 1863., 505-513.

On carbonized turf.
Nicholson. Journ. XIII., 1806 - 36-39.

On the diamonds of the Ural.
Soc. Geol. Bull. IV., 1833-34.. 100-103.

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paper silk wood [illegible]
put in tube ~~[illegible]~~ Bisulphide
Carbon or Carburet H passed
through then heated gently
to red heat, [illegible]
made a Bell [illegible]
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